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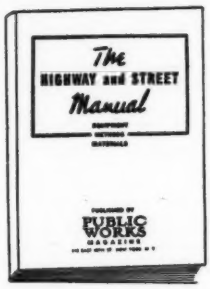

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A. PRESCOTT FOLWELL, Editor

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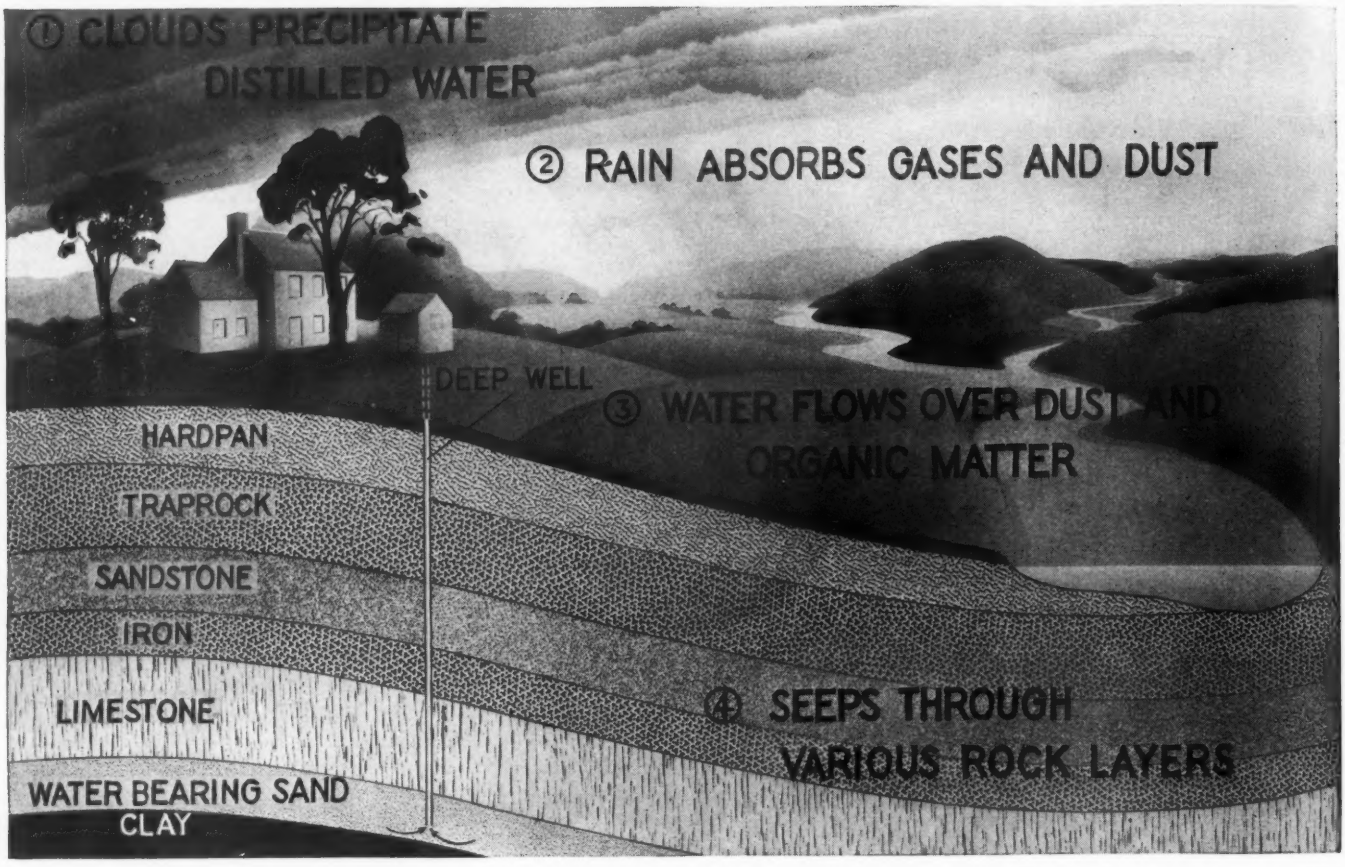

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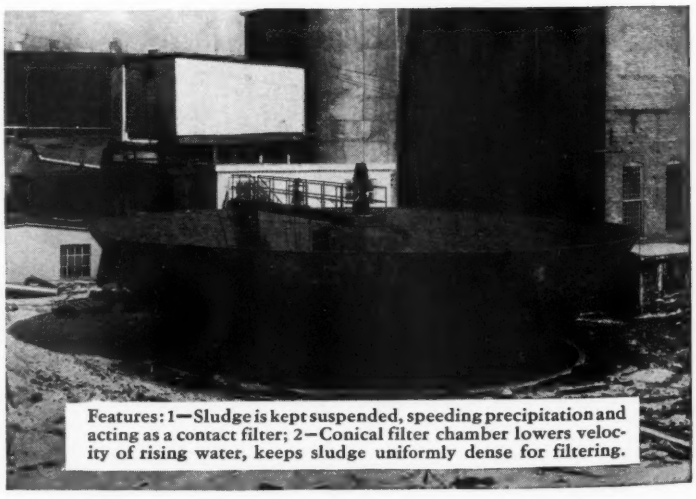

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The Editor's Page

Uniting the Disunited States of America

If there is any one thing in this country that is necessary to our unitedness as a people it is freedom of communication between all parts of the country—communication of ideas, and also of people and of goods. The former we have to a greater extent than any other people. The latter we have nominally, but a number of states have interposed barriers to traffic which have considerably restricted it. Drastic regulatory features of the highway laws of these states have, it is claimed, slowed down the production of defense materials. Fortunately most of these states have been brought to realize this and are removing or ameliorating their objectionable laws, especially those limiting the weights of trucks below those permitted by most of the other states. Instead of requiring traffic to adjust itself to inadequate highways, they are improving their highways to meet the legitimate needs of traffic. This byproduct of our national defense program is a considerable recompense for its cost and hardships.

From Quantity to Quality

Fifty years ago we as a people were criticized for thinking more of quantity than of quality; but there was some justification for it. Our country was doubling in population every thirty years, and it took strenuous efforts to keep even one jump ahead of the resulting demands. With a city's population and water consumption increasing 25% or more every ten years, the quality of the water supplied and of the mains laid were overshadowed by the demands of ever-increasing quantity.

But that condition has passed — probably forever. Only twenty years ago the 68 cities of over 100,000 population were increasing at an average rate of over 25% in a decade; but in the decade just ended the increase was only 4.5%, and it may disappear entirely by 1950. In fact, 30% of these cities lost in population during the last decade.

With no population increase, it might appear at first thought that business prospects were pretty poor for industries dependent upon public service for their existence; no more buildings, sewers, water mains, street paving, etc. But we feel no apprehension on that score, for we Americans have already become interested in quality rather than quantity. We may not further increase the mileage of water mains in our streets, but we will continue to replace them with larger and better ones. We are tearing down old buildings by the thousand and replacing them with new. We are buying more equipment for treating sewage and water than ever before. And few streets and roads are so satisfactory that there is no idea of widening and improving their surfaces.

Even in quantity the demand is increasing more rapidly than the population. In Chicago, for example, the population increase in 1930-1940 was only 0.2%, but the increase in demand for sewer capacity was many times that, due largely to air conditioning. That better surfaces are wanted on more thousands of miles of roads than can be supplied in many years is well recognized, and before that demand is satisfied, and while it is being satisfied, the present surface will need upkeep and replacement.

Along some lines readjustment may be necessary—we will, we hope, have to scrap swordmaking machines and make plow shares instead, and make highway tractors instead of army tanks. But so long as human inventiveness can offer new and better conveniences, so long as science can discover ways to improve water and to diminish the pollution of streams and air—in brief, so long as civilization continues, mankind, even if it should cease to increase in numbers, will not cease to demand increasing quality and even quantity of goods.

How Much Is Seven Billion Dollars?

Congress recently appropriated that amount in one bill, to which it gave consideration of less than a second for each $200,000.

To help engineers—especially highway engineers—to realize how much seven billion dollars is, Henry F. Alexander, city engineer of Lorain, Ohio, sends the following calculation:

A dollar bill is 6.125 x 2.625 inches in size, giving it an area of 16.078125 sq. in.

A billion dollar bills therefore would cover 16,078,-125,000 sq. in. = 111,653,646 sq. ft.

If placed so as to just cover a roadway 30 ft. wide, the road so covered would be 705 miles long. And seven billion bills would cover 4,935 miles—equivalent to the entire length of U. S. Route 6 from Provincetown, Mass., to Los Angeles, Calif.; thence via U. S. Route 101 to Astoria, Oregon; with a few bills left over, sufficient to build 36 freighters such as are used on the Great Lakes and cost $1,418,440 each.

"I wonder" says Mr. Alexander, "whether our Congressmen ever stop long enough to consider how much a billion dollars really is."

If each of our 96 Senators handed out dollar bills at the rate of one a second for eight hours a day, six days a week, it would take them over eight years to hand out seven billion of them.

How Much Is a Billion Gallons?

Another attempt at helping us to realize near-astronomical figures was made by Frank E. Hale, director of laboratories of New York's Bureau of Laboratories, in a paper before the New England Water Works Ass'n. Said he: "The consumption of water by New York City, 980 mgd, or approximately one billion gallons daily, is most strikingly presented by picturing this amount of water stored in 50-gallon hogsheads standing on end side by side. It would take 20 million of these, and they would stretch from Gibraltar across the Atlantic Ocean, across the United States and out into the Pacific Ocean, a total distance of 8,000 miles or one-third the circumference of the earth. And yet every drop of this water must be fit to drink."

They "Ghosted" This Sewer Line!

It slipped under the road with the greatest of ease. The broken arrow shows where an ARMCO Sewer crossed this main thoroughfare without interrupting traffic. Officials were so pleased with the savings in time, money and inconvenience that they again chose ARMCO Pipe for a similar job indicated by the solid arrow.

It happened during the busy holiday season with the temperature 14° below zero. This new ARMCO storm sewer was laid under a main thoroughfare in a midwestern city and traffic never knew the difference.

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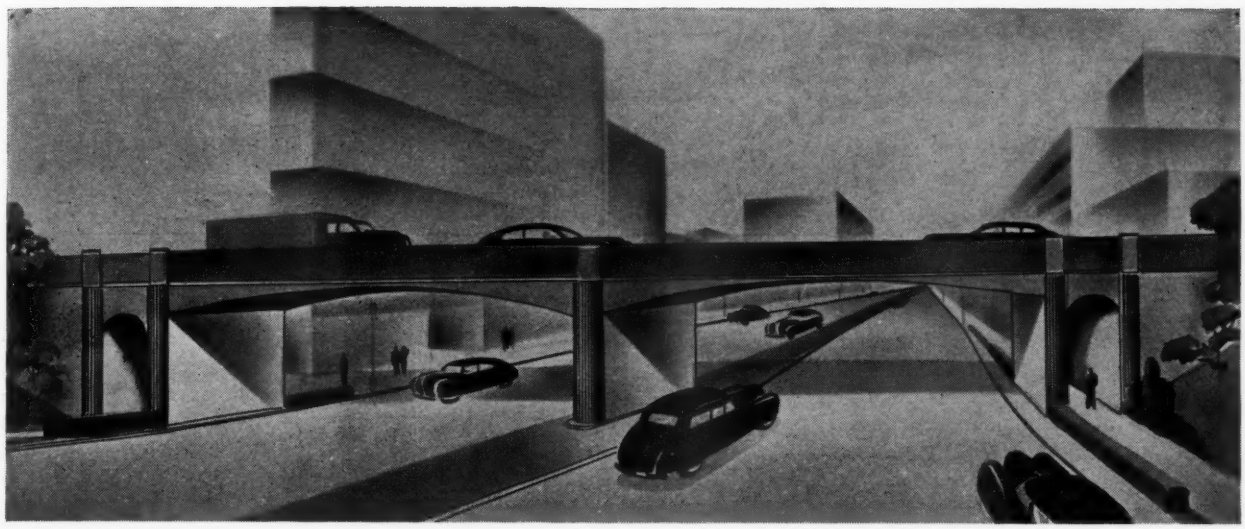


How Cuyahoga County Obtained Public Approval of a Freeway Program

Approval by 66 per cent of the population, including the officials of the 54 municipalities, was obtained by educating the people through newspapers, radio, neighborhood meetings, pictures and maps, billboards and handbills.

By JOHN O. McWILLIAMS
Cuyahoga County Engineer

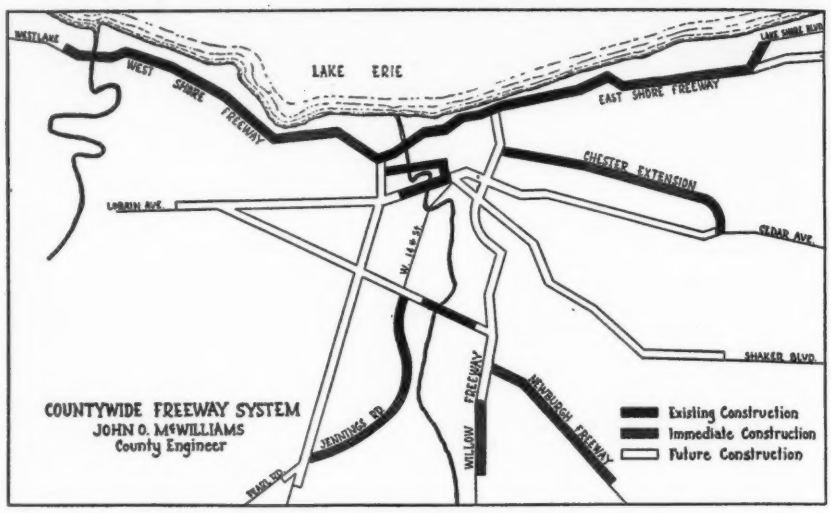
THREE years ago, when we publicly announced an extensive long-range program for solving the growing traffic problem of Greater Cleveland, Ohio, by the construction of a county-wide system of modern freeways or limited-access highways, the response was anything but encouraging. One publication suggested that we step down out of the clouds long enough to apply a little cold patch, noting that I personally was inviting that commiseration which historians reserve for men who dream great dreams ahead of time. In say 1988, when possibly the freeways might be built, it was hoped that I would be remembered.

Two years later, in February of 1940, the freeway idea had become so well accepted and established that the Cleveland Chamber of Commerce recommended an even broader program estimated to cost upwards of forty million dollars more than the sixty million dollar program we had visualized. The report considered our original plan as a possible good starting point and pointed out that the public was paying for such a system of freeways without getting it.

It was not long before the entire county was united behind a movement to construct the six major freeways which we had suggested as those most urgently needed and had recommended for immediate construction. The public was asked to approve a bond issue of $4,500,000 to be used to purchase right-of-way. Commitments were obtained whereby the State agreed to construct the six freeways with state and federal funds, some ten million dollars being estimated as available within a few years time.

At the primary election in May, 1940, the bonds were approved. Despite the apparent bargain offered, selling the bond issue was a task of considerable pro-

John O. McWilliams.



County-wide freeway system for Cuyahoga County, Ohio.

portions. A state law required that, in the case of bonds of this character, a majority vote of 65% had to be obtained for passage. This is a majority of nearly two to one and was generally considered as practically impossible in a large metropolitan community. Some idea of the problem faced is obtained from the election records which shows that 159,854 voted for the issue and 82,004 against, or a majority of 66.09%.

While an intensive campaign of education to bring out the importance and significance of freeways was conducted between 1938 and 1940, the period preceding this time also had a definite bearing on the ultimate success achieved. Long before any specific proposal could be advanced we had to sell the freeway idea.

Educating the Public

On taking office in 1933 we found that little had been done in the way of providing a comprehensive plan for handling traffic and providing for the needs of the future. Like many other large communities, Greater Cleveland was suffering from growing pains and the streets of the 80's and 90's no longer could accommodate the traffic. Congestion was taking its toll in the form of decentralization and disintegration.

We almost immediately set out to make a thorough study of the situation and to find a solution. A comprehensive survey of the movement of traffic was made and the machinery provided for keeping the data up-to-date. This gave us an excellent picture of what the actual needs really were and made it possible to check trends and plan improvements on a scientific basis.

Existing streets being heavily built up and crowded with traffic, we reasoned that widening them would be far too expensive and probably would not solve the problem, since such hinderances as cross streets, traffic lights, parking, and street cars would still be present. Consequently we concluded that sooner or later an entirely new approach had to be taken if the growing congestion was to be eliminated. Freeways, we felt, were the best solution.

We found that, by using parts of several natural valleys, some existing public property and undeveloped industrial land, a system of super-highways or freeways could be constructed that would gather traffic in the suburbs and bring it into the downtown business district free from the usual delay and congestion.

Gradually we began to point out at every opportunity what benefits a solution to the traffic problem would bring and to introduce the freeway idea, explaining just what a freeway was. Selling adequate transportation was the big job to be done at this point, for freeways would seem like fantasies out of a future world until economically justified.

We concentrated our efforts where opposition was most likely to develop. We pointed out to newspapers, taxpayers' organizations, business associations, and civic groups the growing decentralization of the heart of the city proper. We brought home the point that business and industry as well as home owners were dependent upon good transportation. Without transportation, business and industry suffered; suburban development was choked off. We convinced real estate interests, who were gravely concerned with the decline in values, that adequate transportation was the only solution to their problems. We pointed out to merchants that poor transportation was costing them money. Once interested, these groups made studies of their own. Soon they began taking the initiative in asking for the early start on a freeway program.

With the advent of PWA we took advantage of a grand opportunity to give the public a sample of freeway construction. We revived a plan to build a new bridge across the Cuyahoga River valley in the heart of downtown Cleveland connecting the east and west sides, for which bonds had been approved. By seeking PWA aid we were able to expand the original bridge idea by greatly extending the approaches and building the entire structure on the freeway principle. We followed with rebuilding the boulevard along the lake on the west side as a freeway and connecting it to the west bridge approach. The city in the meantime had built a semi-freeway along the lake on the east side and we extended the east bridge approach several blocks to connect with it, thus giving the public its first freeway along the lake for a distance of about seven miles. The freeway fits perfectly into our general plan and is to be extended both to the east and west as part of the approved freeway program.

The Main Avenue bridge, as the new structure is known, was planned and completed in the record time of 17 months and, together with approaches, cost about seven and a half million dollars. Part of the east approach is a ramp crossing lakefront railroad tracks and contains the longest steel plate girder bridge in

the country. It crosses at a skew of 57 degrees, has several curves, is superelevated, and is built on a grade. The two jobs resulted in national recognition and attention and established for the office an excellent reputation for efficient, modern, high-quality and well planned construction. Undoubtedly the jobs had much to do with the passage of the freeway bonds.

In 1938, as the construction of the Main Avenue bridge was well along and the freeway idea fairly well established, we announced the long range program and pressed for the construction of the first six freeway routes. It was felt that the community would approve bonds for the right-of-way cost if financial aid for actual construction could be obtained. This seemed quite likely as such agencies as PWA and WPA were being widely used.

The response to the six freeway proposal was excellent and the bonds were placed on the November ballot. They received a large majority but failed to receive the required 65%. They were submitted again at the November election of 1939 but were so overshadowed by the presidential election and other questions that they received little attention and failed to pass.

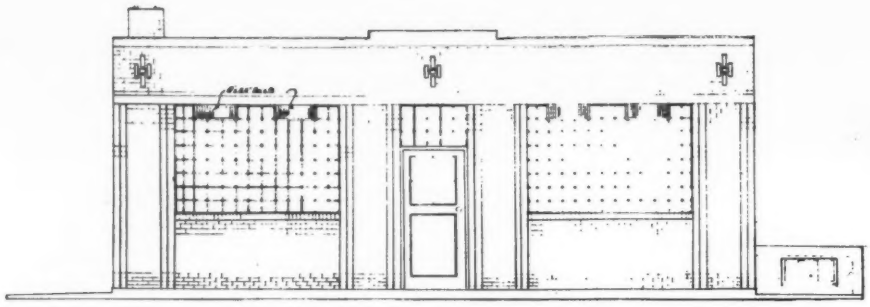
By this time, however, civic associations and business groups had been so well convinced of the need for the freeways and the benefits to be derived that they demanded the bonds be submitted once more.

In all three campaigns a separate campaign organization was formed consisting of civic, political, fraternal, business, real estate, and many other types of organizations. In the last campaign this central body was known as the County Highway Council. The council raised funds for the campaign by private subscription. Naturally we were called upon to take a leading part in the campaign and to furnish the major portion of the ammunition.

The support given the bonds was so complete that not a single organization opposed the issue. The tax organizations took an active part in supporting them. Candidates for office in both parties talked for the bonds. Every possible means of advertising and publicity was employed and many organizations loaned experts in these fields to the cause. The three daily newspapers gave their united support and devoted more than a generous amount of space to the issue. Some 40 suburban weekly and foreign language newspapers likewise approved. Radio stations broadcast bond issue programs and presented talks by experts on engineering, transportation, real estate, taxation, statistics, civic planning and related subjects. Pictures and stories of what other cities were doing, and drawings, diagrams and maps of proposed freeways were presented. Meetings were held in every neighborhood and speakers furnished. Mayors and officials of the 54 municipalities of the county united in endorsing the bonds and individually explained the benefits to their own communities. Billboards, displays in office buildings, and circulars were used. Handbills were distributed to motorists caught in traffic jams.

The campaign was not only a success but attracted attention in other communities. Officials of Detroit came to Cleveland to study the methods we used and adopted a similar plan in successfully promoting the establishment of a five-county authority to plan and build parks and limited-access highways, which included passage of a tax levy yielding funds annually to finance construction.

Main Avenue bridge, Cleveland, with freeway approaches.



South side elevation of pump building.

An Up-To-Date

By A. S. MILINOWSKI
Druar & Milinowski, Consulting Engineers

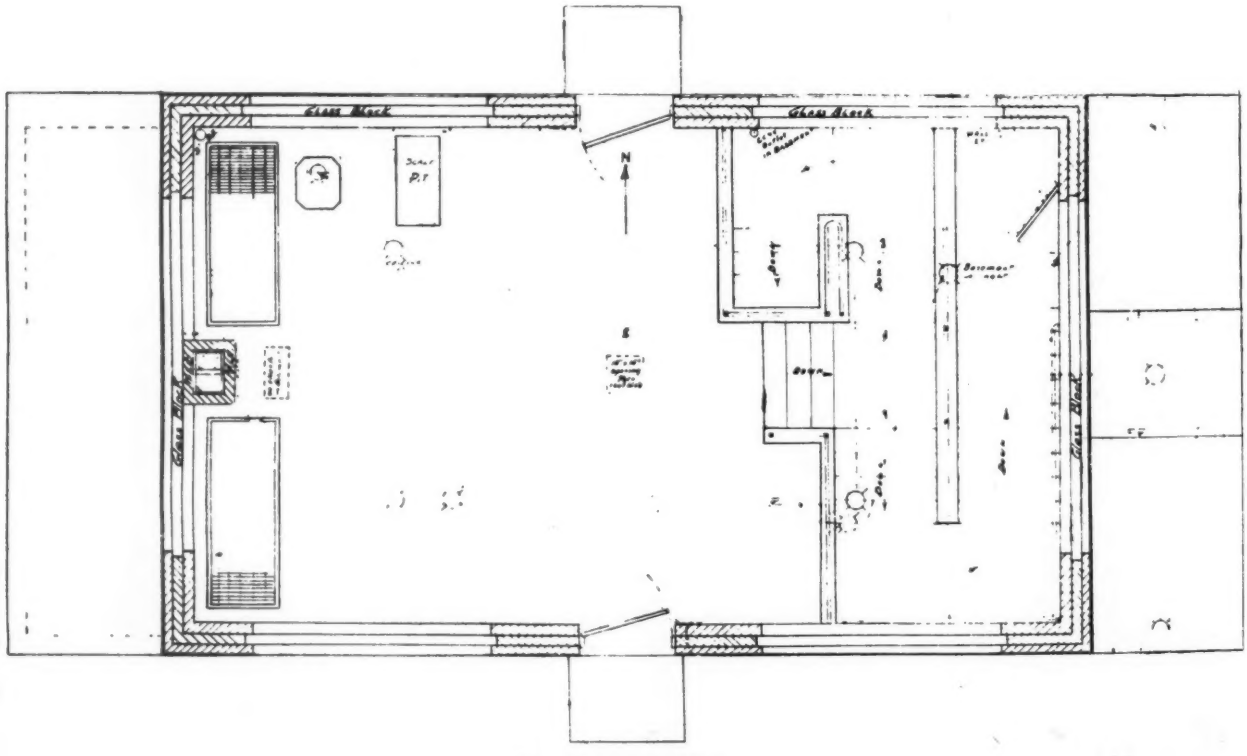
NEW RICHLAND, Minn., which has a population of 863, is located in a rich agricultural territory in south central Minnesota. The sewage treatment plant is designed for the estimated population 25 years hence, 90% connected, with reasonable additional capacity for possible ordinary industrial wastes, such as creamery. At present the wastes from a poultry dressing station go into the village sewers. The outlet is a small natural brook which during the summer is practically dry.

The plant is located at the edge of the village within 300 or 400 ft. of some residences. Referring to the illustration, the circular building in the background is a trickling filter 48 ft. in diameter with gravel filter media about 8 ft. deep. A feature of this filter is the concrete dome, 3½" thick, built by the Hewett system. It has a rise of ⅛ of the span.

The central building contains both the primary and secondary mechanical clarifiers, which are of the rectangular type. The building in the foreground is the main pump building. It houses duplicate raw sewage pumps (centrifugal) for raising the raw sewage to the primary clarifier; duplicate clarified sewage pumps for raising the primary effluent to the rotary distributor of the trickling filter; a plunger sludge pump with suction to four different points and discharge also to four different points; an oil burning hot-water heater for supplying heat to the digestion tank and unit heaters in the clarifier and pump building; a gas space heater utilizing digester gas; and a Wallace & Tiernan chlorinator with three-point application.

The small concrete prominence in front of the main building is the light well over the raw sewage pit, in which is located an aluminum bar screen with 1" clear openings. The concrete manhole top in the foreground is over a diversion or by-pass chamber and the terminal of the incoming sewer from the village.

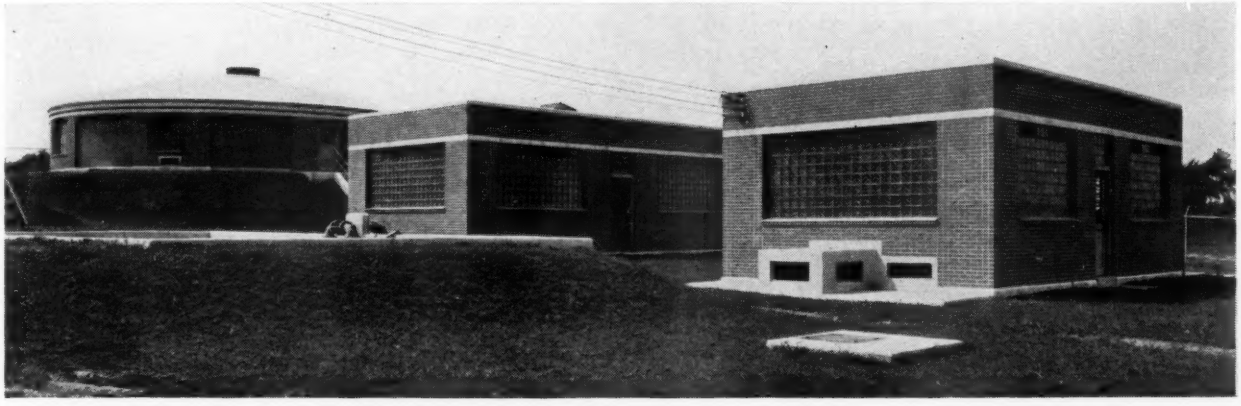
The sludge bed is shown at the left center. This is arranged in two compartments with valves for dos-



Plan of pump building.

Sewage Plant for a Small Community

With a population of only 863, this village built a plant with trickling filter and gas-heated digestion tank, all housed in artistic brick buildings with tiled interiors.



General view of New Richland's sewage treatment plant.

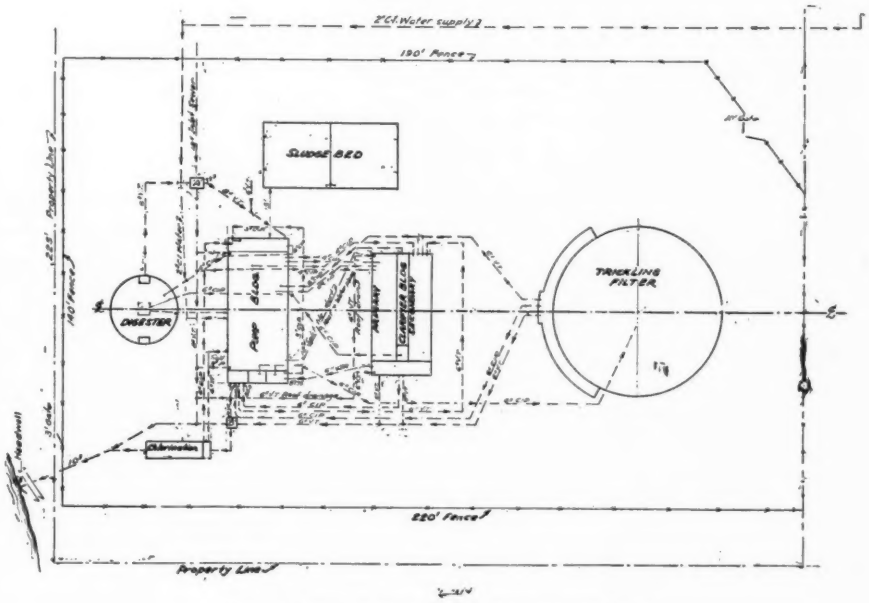
ing either compartment, as desired. The chlorine contact chamber is not shown in the photograph but is underground, to the right of the main building, and is accessible through a manhole cover at each end.

All portions of the plant below ground are concrete, and the superstructures are face brick on the exterior and architectural light cream tile on the inside.

The final actual construction cost of the sewer system was $33,619; and of the disposal plant $51,946. Water supply from the village system was extended to the plant.

An interesting feature is the addition of a mercury switch to flash a high-water alarm in the telephone office downtown in case for any reason the liquid level in the raw sewage pit should rise to a point higher than that for which the automatic starters of the pumps are set, and arrangements have been made with the telephone company to notify the plant operator in case of such alarm. However, all machinery in the pump house is so located behind the protection of a dividing wall that it is not endangered by failure of the primary pumps, as the sewage would pass out to the ditch through a by-pass before any other part of the building than the screen chamber could become flooded.

This was a PWA project, the government furnishing 45% of the cost. The plant is another example of what can be done in locations where appearance, cleanliness and odor control are of prime importance. A small laboratory table with apparatus for carrying on simple control tests has been installed in the main building.



General plan of New Richland treatment plant.

Geodetic, Topographic,

ENGINEERING surveys and maps are made by the WPA as project work, sponsored by public agencies having legal authority to engage in such activities for their own purposes or for the benefit of the general public. In general, the agencies legally authorized to sponsor WPA projects of an engineering survey nature consist of the following: Federal Agencies; city, township, and county engineering departments; boards of selectmen; state public works departments; state and local boards of education; state universities and colleges; conservation departments; state and county highway departments; state and local planning boards; aviation commissions; state bureaus of mines; and the U. S. War and Navy Departments, etc.

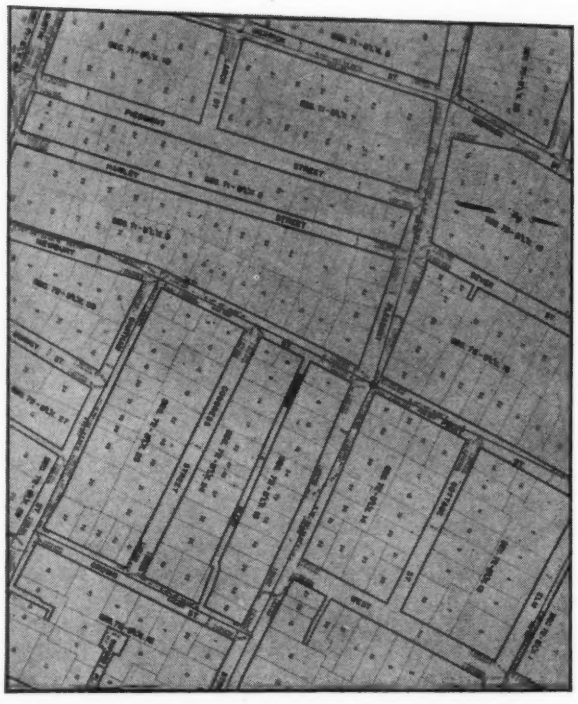
The sponsor's contribution consists of material, equipment, supplies, and other non-labor items, such as office rental, transportation, etc. In the operation of engineering survey projects, it is highly important that technical supervisors and other key supervisory personnel be employed by the sponsor. This arrangement stabilizes the supervision; and the fluctuation in the lower employment brackets of WPA has little effect upon the unit costs of the work.

Although there are many varied types of surveys executed with the assistance of WPA, the general types are as follows:

- Geodetic Control
- Topographic
- Boundary
- Underground and Surface Structures
- Hydrographic
- Geologic
- Cross Sections and Profile
- Drainage and Flood Control
- Soil
- Test Borings, Pits, and Cores
- Surface and Underground Water Resources
- Aerial Photographic
- Building Locations
- Plans of Existing Public Buildings
- Defense Mapping

Many of the projects submitted include only one type of survey, but a consolidated or master project may be initiated which proposes several major items. The master project is usually developed when the local sponsor is planning a long-range survey program, or for the purpose of facilitating the technical and administrative supervision of the work.

Since June 1939, the data concerning the volume of work, the amount of Federal funds involved, sponsors' funds pledged, and the personnel are approximately as follows:



Sectional view showing the average spacing of precise traverse control.

Number of applications approved	442
Federal funds approved	$20,395,239
Sponsors' funds pledged	4,888,284
Number of WPA jobs made available	23,096
Sponsors' personnel	889

One type of work in this field which has been of great interest to sponsoring agencies is the survey of underground and surface utility structures. The mapping of public and private utilities has been neglected in this country for many years. A large percentage of the urban areas have little or no information in regard to these structures, except those that have been constructed within very recent years.

The policy of the WPA concerning the operation of the survey projects has been that such work must conform to the best engineering practice resulting from the standards established by professional societies, and those recommended by various Federal agencies having years of experience in the survey and mapping field.

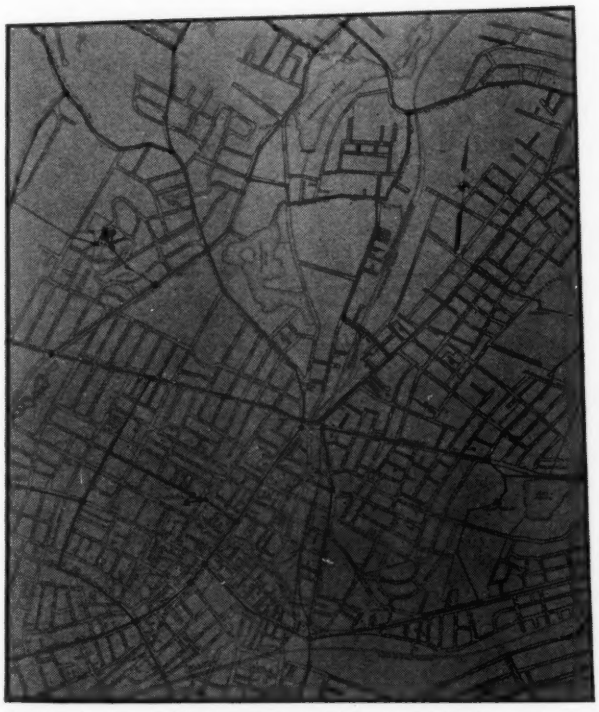
General and Subsurface Mapping

The WPA assists in executing all types of engineering surveys, in the preparation of various kinds of maps, and in the collection of information for plotting upon existing maps.

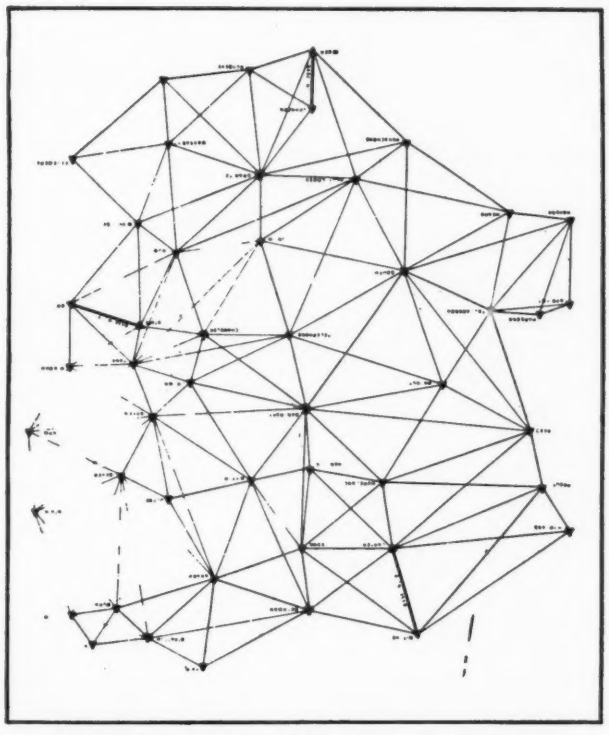
In the operation of projects executing geodetic control in the urban or metropolitan areas, the work must conform to the procedures established in Manual No. 10, "Technical Procedure for City Surveys," adopted by the American Society of Civil Engineers in 1934. On projects of this type for rural or statewide areas, the specifications of the U. S. Coast & Geodetic Survey are required, and the project applications are referred to that agency for comment and recommendation before the final review is completed.

One of the phases in the mapping program that has been somewhat disturbing is the apparent lack of concern for appropriate map scales. The WPA on occasion has been requested to assist in preparing maps of both urban and rural areas in which the proposed map scales did not conform to "standard scales." The sponsor's reason for proposing odd scales is generally based upon the desire to match old available maps that have become obsolete.

The WPA has recommended a scale of 1″ = 200′ as a standard scale for topographic maps in urban areas, with contour intervals ranging from one to five feet, depending upon the maximum difference in elevation. The various types of maps needed for operation on large-scales, such as utility structure surveys, block maps, tax maps, etc., should be an even divisor of 200 feet. Such scales not only facilitate reproduction problems, but are advantageous when used by architects. Small-scale maps in urban or rural areas are recommended to be 1″ = 400′, 800′, 1000′, etc.



Sectional view of block survey, showing determination of statewide plane coordinates for permanently preserving the street line boundaries.

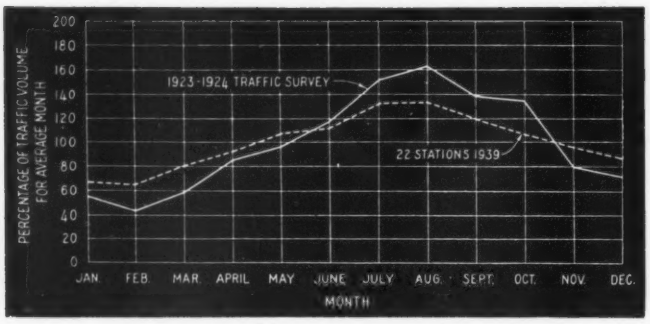


Triangulation network of Worcester geodetic survey.

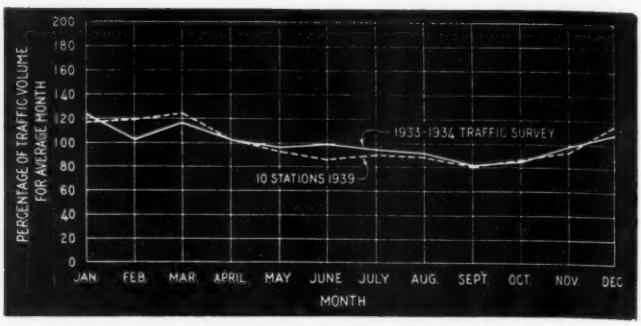
An important factor in a well-organized engineering survey program is believed to be the sequence in which the projects are operated. The WPA has found that the most satisfactory operating sequence for engineering surveys in the average urban area, which is the result of experience with all types of surveys executed under the WPA program, is as follows:

1. Godetic Control
   a. Triangulation
   b. Traverse
   c. Levels
2. Topographic

(Continued on page 41)


PERCENTAGE OF TRAFFIC VOLUME FOR AVERAGE MONTH
1923-1924 TRAFFIC SURVEY
22 STATIONS 1939
JAN. FEB. MAR. APRIL MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
MONTH

Changes in seasonal variation of traffic flow in Pennsylvania.


PERCENTAGE OF TRAFFIC VOLUME FOR AVERAGE MONTH
1933-1934 TRAFFIC SURVEY
10 STATIONS 1939
JAN. FEB. MAR. APRIL MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
MONTH

Changes in seasonal variation of traffic flow in Florida.

Automatic Recording of Traffic Provides Valuable Records

ONLY a few years ago information with regard to the volume of motor-vehicle traffic by hours throughout the year was available only at a few bridges, where it was obtained incidental to the collection of tolls. Usually these data were summarized and reported only as an annual total or, at best, subtotals were obtainable by months. The need for complete traffic flow information was recognized, but until the State-wide highway planning surveys were begun no concerted effort was made to obtain such data on anything approaching a Nation-wide scale. Today automatic traffic recorders are being used in 46 States to obtain continuous records of traffic flow at more than 500 locations.

The principal uses of these data are as follows: (1) In measuring the time during which a section of highway is congested, and the fraction of the year's traffic that moves under conditions of congestion; (2) in compiling a traffic record, obtained under widely varying climatic, geographic, and economic conditions, essential in planning extensive traffic surveys such as those formng a part of the highway planning surveys, and in which some traffic information is obtained for every mile of publicly used highway; (3) in acquiring knowledge of the variations in traffic volume required in expanding short traffic counts covering but a small fraction of the year to obtain reasonably accurate estimates of the total traffic for the year; and (4) the traffic record is of vital importance in the study of traffic trends and their relationships to economic factors and to probable future traffic. It is mainly with regard to the latter use that the record is inadequate; and this deficiency is being reduced as the records accumulate with each passing month and year.

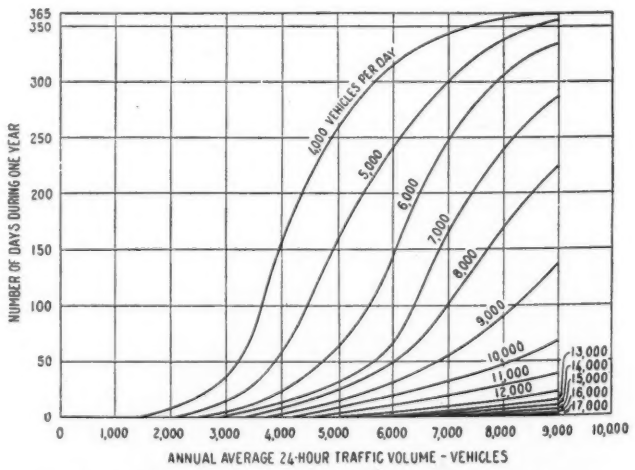
The automatic traffic counters used in the State-wide highway planning surveys are of two general types; one designed to be installed permanently at key locations and referred to as a fixed-type recorder; and a portable counter used in obtaining short counts at a large number of widely separated locations.

Analysis of data from typical stations throughout the United States shows that there was an extremely wide variation in the ratios between traffic for maximum days or hours and the average annual daily traffic, but this variation was considerably less at locations in the southern States as compared with those in the northern States. Traffic on the maximum day was normally 233 percent and the maximum hour 25.4 percent of the annual average daily traffic. It is uneconomical to design the average highway for a greater hourly volume than the value exceeded during the 30 peak hours each year, and little will be saved in the construction cost and a great deal lost in expediting the movement of traffic if the design will not handle the volume exceeded during the 50 peak hours. However, the variation in traffic flow between locations is such that detailed data are necessary for a complete engineering analysis of the traffic facilities required at any particular location.

Tests of various schedules of operation that are used in highway planning surveys indicate that eighteen 8-hour counts properly scheduled throughout the year produce results within practical limits of accuracy; that the short count schedule by single hours, or shorter periods, is not as accurate, and its use is limited to relatively compact areas such as a city where time loss and cost of travel may be reduced.

A study of the invariance in seasonal and other types

(Continued on page 22)



Number of days during one year that various 24-hour traffic volumes were exceeded.

Constructing Concrete Wells in the Susquehanna River

The wells, replacing old cast-iron ones, receive water from the river which has filtered through several feet of the sandy river bed. River turbidity of 4,000 is reduced to 40.

By LeROY DEITRICK
Superintendent, Danville Water Department

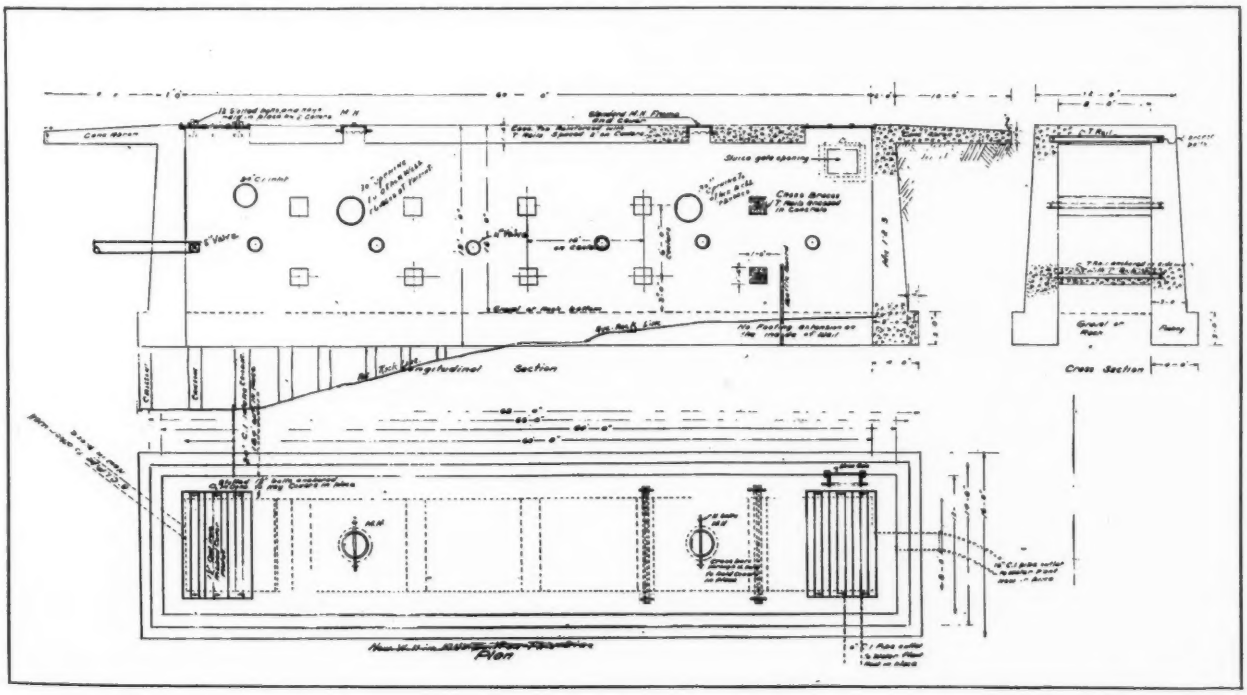
LeRoy Deitrick

THE town of Danville, Pa., is located on the north branch of the Susquehanna river about 50 miles southwest of Wilkes-Barre. It has a population of about 7,000 and uses the Susquehanna river as its source of water supply. The original water system was installed in 1872. Instead of taking raw water direct from an open intake, the commissioners conceived the idea of setting two cast iron rectangular wells in the river bed and using the water from them. The wells were 48 ft. long, 8 ft. wide and 12 ft. deep, and are provided with a top made of sixteen 3-ft. by 8-ft. plates which were bolted to the sides. They were built in 3-ft. sections, bolted together and set in the river so as to project one foot above the river bed. The openings around the top were sealed by calking with oakum. The suction lines of two raw water pumps were run into each of these wells and the wells were connected to each other.

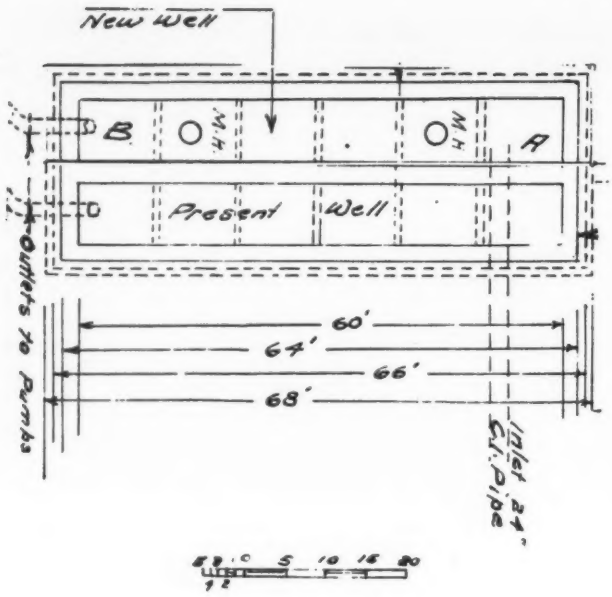
The bed of the Susquehanna river at this location is composed mostly of sand and gravel, so that all the water going into the wells had to filter through the river bed and enter the wells through their bottoms. This water was then pumped directly to the filters. Everything was fine with this system until 1914 when, due to increased consumption, the wells did not take in water fast enough to supply the plant. The commissioners then installed a 24-inch cast iron pipe extending from the wells into the river so that it would bring raw water direct into the wells, and a sedimentation basin was built and the water clarified by chemical coagulation and sedimentation. The consumption at this time amounted to about 950,000 gallons per day and the system was a direct pumping system with no storage supply available.

In 1934 we constructed a 3,000,000-gallon concrete reservoir under a C.W.A. project. In 1937 the cast iron wells in the river began to crack and fill with sediment so that we had to clean them out every summer. In fact, they filled so fast that it cut down the capacity of them and gave us trouble in pumping. In 1938 we conceived the idea of taking out one of these wells and replacing it with a concrete structure, which we did with WPA help and under my supervision.

Our procedure was as follows: We built a coffer-



Plan and section showing construction of wells.



Plan of existing and new well.

dam with steel sheet piling alongside one of the wells and then excavated to a depth of about 15 ft. At one end of the excavation we struck a ledge of shale at a depth of 13 ft., but at the other end we found nothing but sand. Where we struck the ledge of shale we cut to a depth of 1 foot and a width of 4 ft. to set the footings on; at the other end we drove 18-inch steel pipe caissons at 6-ft. centers, pumped these out and filled them with concrete to act as piers for the footing. These pipes were driven into the sand until they struck rock. A footing was poured 3 ft. by 4 ft. to support the walls, which were battered from 3 ft. at the bottom to 2 ft. at the top, which is flush with the river bed. After building the forms for the walls but before pouring the concrete, we placed cast iron pipes through the wall form with valves on the inside, the pipe itself going through the wall and extending out past the form into the river bed for a distance of 6 feet. These pipes were all placed 8 ft. from the top of the well. The new well was 60 ft. long by 12 ft. wide. We used one 8-inch valve and pipe in each end and three 6-in. and three 4-in. pipes along one side of the wall, to feed the water from the river bed into the well. On the other side of the well, instead of making the wall battered we made it 3 ft. thick all the way to the top and installed two 30-in. pipes in it. This was done with the intention of putting another well alongside of this one and using this wall as the center wall, the two 30-in. pipes through the wall being used to connect the two wells.

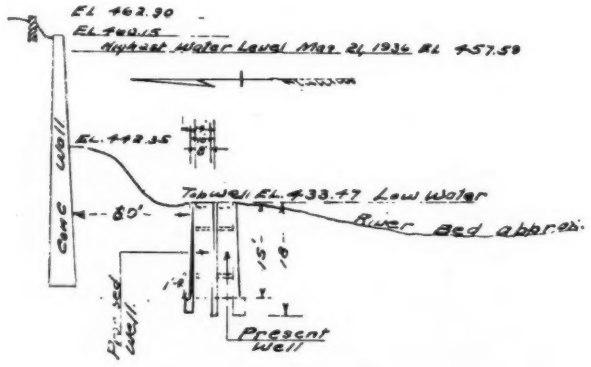
After the walls had been poured we placed the top, which was of concrete 18 inches thick; in which, at each end, we put three 2-ft. by 10-ft. cast iron plates to make it possible to enter the well to clean it out at any time if necessary. Valves boxes were also placed so as to be able to shut off the supply coming in through the laterals at any time.

We also installed a sluice gate on the side toward the river, to be opened in case we should wish to draw heavily on the well and the water would not filter in fast enough. We also connected to the well the 24-in. pipe to the middle of the river and installed a valve on the inside so that we could take in raw water through it at any time in case of increased consumption. The well was then connected to a suction line from our raw water pumps, the connection being made on the down stream side of the well. After the well was completed we packed the space between the cofferdam and the well with quarry-run limestone, taking care to lay rocks around the lateral pipes so as not to let large particles enter the well.

This well was completed at a total cost of $23,-171.89, including WPA labor, the cost to the Borough being $9,000. This included the cost of a new cement mixer, a new pump, shovel rental, steel sheet piling rental, and other items.

In 1939 we worked up a project for another well to be built alongside of the new one, but due to the late approval of the project by the WPA we did not think it advisable to start so late in the summer due to the fall rains usually resulting in a high river level. In the spring of 1940 we went ahead, took out the old cast iron well and proceeded with the construction of another well alongside of the new one. It was designed the same as the other one and when completed we connected the suction line of the other pump into it and abandoned the old cast iron wells altogether. The cost of this new well to the Borough was $3,000. These wells have been in use now about 6 months and we are getting very good results. Several times we have had river turbidities of 4,000 while the water coming into the sedimentation basin showed a turbidity of only 40. We expect to realize quite a saving in chemicals alone.

In excavating for these wells, in both cases, we struck springs in the sand which produced streams about 4 in. in diameter. Both of these are encased. We have constructed the wells to be pressure tight so that at any time if the veins should gradually fill from sediment we could apply pressure to force them open. The average pumpage of 900,000 gallons per day now seems to have no drawdown effect on the level of the water in the well, the water filtering into the wells as fast as we take it out. The wells were designed by Lewis Forney, Chairman of the Water Committee and myself, as superintendent of the water department. The plans were drawn by A. Cameron Bobb, Borough Engineer. Construction was under my supervision.

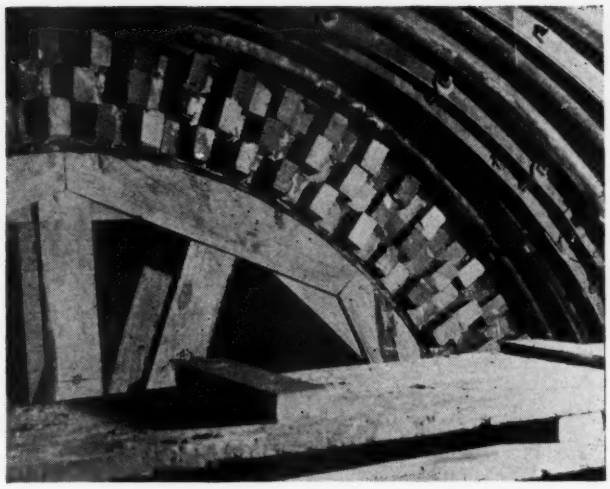


Section of well and river bed.

Pennsylvania to Continue Bridge Program

Pennsylvania has about spent $2,000,000 appropriated for strengthening and otherwise modernizing its highway bridges and the State Highway Department has authorized the expenditure of $3,000,000 additional for improving the bridges on its rural highway system. This new program is to begin June 1st.

Portion of finished tunnel. Three layers of brick inside a steel housing.



Form for placing brick inside of steel housing for 8-foot sewer.

Tunneling an 8-Foot Sewer 40 Feet Below the Street

TERRE HAUTE, Ind., is building a relief sewer to cost about $1,000,000, using WP Aid. The storm sewer capacities in the center of the city had become so inadequate that water backed into basements and streets, and engineers advised as the remedy the building of an 8-ft. relief sewer about 5,000 feet long to the Wabash river.

A considerable part of the length is 40 ft. or more below street level—the maximum depth is 42 ft. Most of the sewer is located in Walnut St., which runs through a thickly settled residential area where an open trench 40 ft. deep would have caused great inconvenience, and it was decided to build it in tunnel; study of soil and ground water conditions having indicated that no air pressure would be needed, and the relative costs being roughly estimated at about $90 a foot for tunneling and $114 by open trench.

None of the WPA laborers available had tunneling experience, but a sufficient number were trained by Tim O'Leary, the superintendent of construction, and Pat Haley, his assistant; and the work is now well ahead of schedule, and there has not been even a minor cave-in or other mishap. The method used in training the labor on this job was simple. The superintendent of construction carefully picked 36 men from the several hundred available on WPA rolls and gave them a short but intensive training course. At first they made slow progress with the tunneling, but soon they were working with the precision of experienced "sandhogs." Then another group of 36 were trained and this provided 72 qualified workers—a sufficient number to permit the work to be carried on with three crews working six hours each.

The tunneling is carried forward from shafts spaced two or three blocks apart. These are 15 ft. in diameter, lined with Armco corrugated steel liner plates, and contain stairs to give access for the workmen and an elevator for removing excavated material and delivering the building materials. Simple buildings were erected over the shafts to protect them from the weather and prevent observers from falling in.

The soil is a moist, running gravelly sand, and in excavating it special precautions were necessary to prevent the material from flowing in. The method used was to set up a vertical heading of breast boards braced back against a substantial frame. Beginning at the top, one of these boards was removed and, after a little excavating, a series of 1″ x 6″ x 30″ poling boards were placed outside the circumference of the tunnel with the rear end resting on the preceding liner plate and the front end wedged into the solid material ahead. Hay was used to help prevent sand from coming through the cracks. The soil below the poling boards was scraped away, the top breast board braced against the new face, and the next breast board removed and the soil behind it excavated; and this was repeated

Entrance to tunnel and building housing the lift.

until all the breast boards had been advanced about 18 inches.

The excavated soil was shoveled into rubber-tired buggies, which were pushed or pulled over a double plank runway to the elevator shaft, hoisted and emptied into a hopper, from which it was trucked during daylight hours.

When sufficient soil had been excavated, a ring of liner plates was placed and bolted to the preceding plates. These plates are Armco heavy-duty type with box-like corrugations 2″ deep, of No. 12 gauge steel, 18″ wide, with flanged edges, furnished in 56″ lengths. Nuts welded to the outside of the longitudinal seams make it easy to bolt the plates together. These form a tube 10 ft. in diameter, inside of which is built a 12″ brick lining.

Line, grade and diameter were checked about every 6 ft. and any corrections found necessary were made by inserting washers between adjacent plate flanges. In one section, headings from two shafts met within ½″ in line and right on grade.

The brick lining was laid in three 4″ rings, a simple wood template 4 ft. long being used for the arch.

Robert E. Gibbons is city engineer. Assistant city engineer Paul Meadows was in immediate charge of this work. Frank Byrne is area supervisor for PWA, and R. Pike is State director.

Sewage Treatment at Collinsville, Ill.

By JOHN B. VIGNA
Superintendent of Public Works

COLLINSVILLE, Ill., built a new sewage treatment plant and rebuilt an old one in 1939. The latter as originally built in 1929 consisted of a small Imhoff tank only serving the south side sewer district. Topographically the city is divided into three districts —south side, west side and north side. By building a lift station we were able to combine the sewage of two latter, pumping the sewage from the west side through a 15″ line 8,772 ft. long across the city to the north side sewers. This was a WPA job and hand labor was used for all trenching and much of the digging around the plant, but a clamshell and drag line were used for most of the excavating for an Imhoff tank.

The new north side plant consists of an Imhoff tank 54 x 64 ft. by 30 ft. deep, and two trickling filters each 100 ft. diameter, with a secondary tank and laboratory. At the old south side plant we added a 100 ft. trickling filter, a secondary tank and laboratory. Each of the trickling filters contains 1.89 foot-acres of stone.

Sewage treatment plant at Collinsville, Ill.

In building the trunk line we used a bituminous jointing compound, chiefly to resist root penetration. The average depth of trench was 12 ft. and most of it had to be shored. The dirt was cast out by stages, using platforms resting on the braces. This made progress pretty slow until we had the work organized and the men gained experience.

When I took charge in 1931 I made a complete survey of the sewerage situation and recommended sewage treatment by the special assessment plan, but after three public hearings this was turned down. In 1938 we obtained the WPA assistance, and the rest of the cost is being met by a bond issue which is being financed by our municipal water department; which it will be able to do if we keep the department from becoming a political football and continue to operate the water and sewer plants as economically as we are now doing, still giving good service.

Automatic Recording of Traffic Provides Valuable Records

(Continued from page 18)

of traffic variation over a period of several years provides a measure of the limitations in the use of factors in estimating annual traffic from observations covering but a small period of time, possibly a few hours. The rather remarkable uniformity in such factors provides considerable confidence in the accuracy of the estimates.

As the traffic records accumulate they will permit an analysis of the traffic trends at a large number of points widely distributed throughout the country and should furnish data useful in setting up regional or national business indices. The relatively brief record now available has already proved of value in making estimates of traffic increases on major segments of the highways and streets of the Nation.

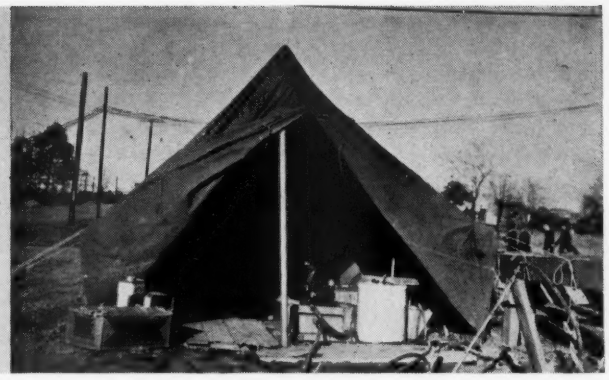
Reconditioning 40-Year Old New York Sewers

Some 400 men, working 15 to 30 feet beneath the streets, Bronx Borough, New York, are reconditioning five miles of trunk sewer line that were originally built 40 to 50 years ago, this being a PWA project. The improvement includes grouting, repairing and pointing up all brick work, and the reconstruction of 23 man-holes.

The men are protected from noxious fumes and poisonous gases by air blowers, and equipped with safety belts, life preservers, gas masks and carbon monoxide detectors. The work is carried on without interfering with the flow in the sewer, which normally is from three to four feet deep. This, and special engineering and safety problems, including the possibility of increased flow due to heavy rainfall, combine to make this sewer job more than usually difficult. At some locations it is necessary for the men to work in three feet of water until platforms can be built, and in the lower courses of the sewer, tidal conditions have to be combatted. Illumination is provided by means of gas-driven generators located on the street with leads extending down the man-holes into the sewer.

The job is scheduled for completion about August 15th.

Heavy-duty "Midget" feeder, electric motor driven connected by long belt so as also to drive a "Du-Self" feeder at Camp Robinson.



All-hydraulic feeder sterilizing mains at Camp Robinson. The unit is inside tent adjacent to hypochlorite solution crock.

Hurry-up Sterilization for a Defense Project

A 7½-mile supply main to Camp Robinson was sterilized in 24 hours, using 140 pounds of chlorine. Also 7 miles of distribution mains and many miles of services were sterilized.

THIS is the story of how 7½ miles of 16″ water main was sterilized in 24 hours; also 24 miles of 6″ to 16″ pipe in a distribution system at a less phenomenal rate. The distribution system was in Camp Joseph T. Robinson and the 7½ miles was a 16″ steel pipe which brings the water supply to the camp.

Camp Robinson is a standard tent camp planned for 30,000 men, located on a plateau four miles northwest of Little Rock, from whose municipal water works the camp supply is obtained. The steel pipe line begins at the clear water basin, changing to two 12″ cast iron pipes where it passes under the Arkansas river, and terminates at the entrance to the camp in a cone valve which has the same elevation as the clear water basin. As the average elevation of the camp area is about 30 ft. higher than this, the water is pumped against a pressure of 60 to 90 lb. The distribution system is of the looped grid type consisting of 11.2 miles of 6″ pipe, 11.8 miles of 8″ and 1.3 miles of 12″ and 16″.

Sterilizing the Distribution System

Camp Robinson occupies the site used for Camp Pike of World War No. 1, and by the State National guard as a training camp for the past ten years, a small water supply for which was obtained from deep wells; and this supply was used for the first two weeks' operation of sterilizing the distribution system, but as it was limited in quantity and was used for construction purposes also, sterilizing with it proceeded slowly. (The line bringing the new supply to the camp had not yet been completed.)

Before starting sterilization operations, it was agreed that the treatment should consist of adding sodium hypochlorite solution to water as it was admitted into the mains at such a rate as to give a chlorine residual of approximately 50 ppm. As no meters were available, the flow of water was approximated by opening the inlet valve until the flow as determined by bucket measurement from a nearby fire hydrant was approximately determined.

A 10% solution of HTH was pumped into the mains by means of a portable All-Hydraluic Chlor-O-Feeder, corporation cocks being tapped into the mains for this purpose at five locations selected throughout the camp. The treated water was directed through the distribution system from these five points of injection and allowed to slowly progress through the pipe system until the total distance traveled averaged about one mile of pipe. While this treated water was flowing into the pipes, the engineers maintained a constant patrol of the pipe lines to locate leaky joints, breaks, or incomplete connections to service lines. As the water passed into the pipe system it was progressively allowed to waste from fire hydrants, thereby washing out trash accumulated in the pipes during the construction operation. When a given line of pipe had been thus treated to its end and the chlorine residual had been found to approximate 50 ppm, the outlets were closed and the treated water was left in the pipes to penetrate jointed materials and to complete the sterilization of the mains. Electricity was available in two locations in the camp area, and at these points a motor-driven heavy-duty Midget Clor-O-Feeder was used to inject the hypochlorite solution.

At the beginning of operations, difficulty was caused by the obstruction of Chlor-O-Feeder check valves by the lime residual from the solution crocks. As the operators became more experienced in their work, however, this difficulty was avoided by maintaining the suction line well above the bottom of the crocks and by washing the crocks after every fourth or fifth charging.

We also had trouble because of the large amount of oakum fibers that accumulated around the filter of the hydraulic Chlor-O-Feeder. It was found that the best way to get rid of this fiber accumulation was to clean the filter screen with a high pressure air jet.

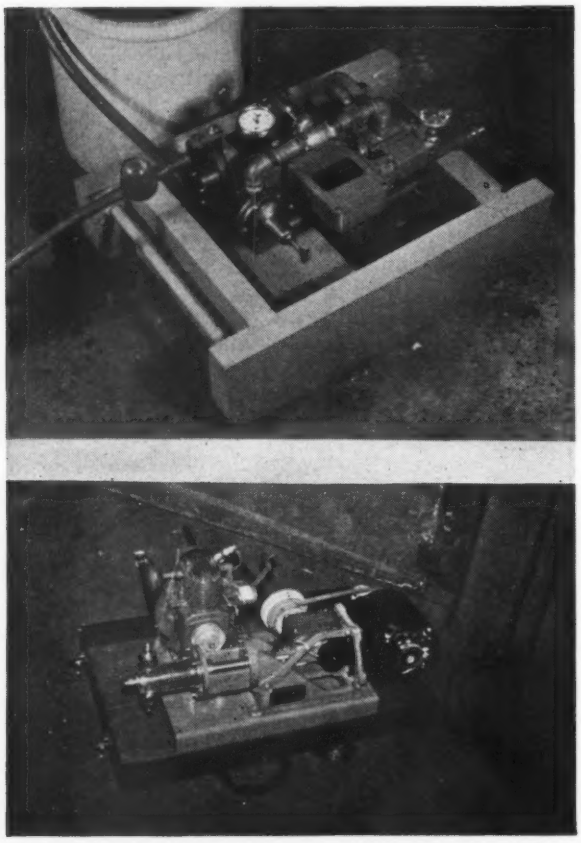
Sterilizing the 7.5 Mile Supply Line

The sterilization of the seven and one-half mile supply line was a somewhat different operation. It required 350,000 gallons of water to fill this line, which

in turn would require 140 lbs. of chlorine to obtain a 50 ppm treatment. The capacity of our Chlor-O-Feeder was about 40 lbs. to 50 lbs. per day, indicating about three days operation to satisfactorily treat this amount of water. Because the time for opening the camp was drawing perilously near, and the need of fire protection at the camp was great, the engineers urged that we sterilize this main pipe line with the greatest possible speed, and that it be done in 24 hours, if possible. We happened to still have in our hands a Du-Self Chlor-O-Feeder which we had contracted to install for the U. S. Engineers at one of the flood control dams being erected in Arkansas, and the Government engineers agreed to lend this to the camp quartermaster for a sufficient time to obtain a water supply into Camp Robinson. We therefore decided to make our pumping installation by using the electric Chlor-O-Feeder in conjunction with the Du-Self Chlor-O-Feeder, both machines to be operated by a single motor.

The pumps for serving Camp Robinson are rated at 1,000,000 gallons per day, but the water works operator agreed to choke down the flow by supplying the line from high pressure circuit operating from the pump station to approximately 300,000 gallons per day. Because of this reduction in flow, the Camp Robinson meters were not effective and we were therefore again in the dark as to the amount of water actually flowing into the pipe line.

Though the pipe line was reported finished at noon on December 20th, it was 7 o'clock in the evening before the emergency back pressure valve at the entrance of the pipe line was completed and before water could be turned into the new 16″ line leading to the camp. When everything had been made ready, we started the Chlor-O-Feeders and the water. The first water in the pipe line raced down the 150 ft. drop to the river valley below the reservoir and immediately flooded the air valve manholes where, because of the failure to receive the air valves, ordinary gate valves had been left open to initiate the operation of the line. But in five or six hours operation became normal and the feeding of the sterilization solution settled down to a routine job, except for the fact that the operating crew was kept busy in refilling the solution crocks. The Chlor-O-Feeder was operated at 36 strokes per minute and the Du-Self at 92 strokes per minute, and in spite of this high speed operation with a very heavily charged solution, no trouble was experienced except an occasional blocking of a check valve by lime particles.



Top: All-hydraulic "Chlor-O-Feeder" mounted on skid. Bottom: High-pressure "Chlor-O-Feeder" driven by either motor or gasoline engine.

At 5 o'clock, December 21st, 22 hours after starting, water began to flow from the nearest fire hydrant in Camp Robinson. This was the water that had accumulated in the 12″ pipes as they were laid under the Arkansas River. At the end of two hours of additional pumping, samples of the water flowing from the fire hydrant were found to contain better than 50 ppm of chlorine per minute, this test being made by the chemist of the water company.

Sterilizing the Service Lines

In order to sterilize the service lines, which total many miles varying from ½″ to 4″ diameter, the engineers decided to increase to a minimum of 2.0 ppm the chlorine residual in water furnished from the little Rock pumping station at .2 to .3 ppm. The hydraulic Chlor-O-Feeder was installed at the cone valve at the entrance of the camp, but after two days of operation against pressures reaching as high as 125 lbs. per sq. inch, it was moved to a point within the camp area at which, by the closing of only two 8″ valves, all water entering the camp could be treated, and at which, due to its elevation, the pressure averaged from 45 to 60 lbs. per sq. inch. The quantity of water being pumped into the camp was learned by telephone reports from the city's pumping station two or more times per day, and the quantity of chlorine pumped into the water was adjusted according to these reports. Residual chlorine tests were made at various points throughout the camp and at the stand pipe and it was found in most cases that the desired residual was maintained. After five days of this operation, 47 samples of water taken throughout the camp and one sample at the point of entrance to the camp for bacteriological examination showed coliform organisms present in the water at the point of entrance and at only two points in the camp areas. The chlorination treatment was therefore continued for an additional period of 6 days, when samples taken at the same points were found, in all cases, to be free from coliform organisms.

The sterilizing of the mains in the camp area required a total of 27 days, 16 days of which was done with the limited water suply from the national guard camp system. During this time 10,300 ft. of 6″ pipe, 23,050 ft. of 8″, 1,500 ft. of 12″ and 2,050 ft. of 16″ pipe were treated, and 172 lbs. of HTH was used.

During the next 12 days, when an ample supply of water was available, 50,600 ft. of 6″ pipe, 39,150 ft. of 8″, 800 ft. of 12″ and 1,850 ft. of 16″ pipe were treated, 220 lbs. of HTH being used.

The excess quantity of chlorine used over the theoretical requirement was containd in the water used in flushing the pipe lines.

Black and Veatch, Kansas City, Missouri, are supervising engineers of Camp Robinson. The above work was done by the Lund Engineering Company under the direction of A. V. Ferry, Chief Resident Engineer, and Charles F. Samuel, Water Supply Engineer.

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Digging for drains

to intercept ground water, and

placing drain with porous backfill.

Outmoded Rural Highways Modernized by Drainage

By H. R. TURNER,
Associate Highway Engineer, Connecticut State Highway Department

THE State of Connecticut has been maintaining in the Highway System, 1,447 miles of older type highway pavement constructed originally of gravel base or waterbound macadam. A large part of this mileage consists of old graded roads surface treated with tar. On the older highways, little attention was devoted to stabilizing the sub-base, aside from installation of Telford, stone or vitrified tile drains in extremely wet areas.

A survey conducted in 1939-1940 disclosed that 185 miles of highway pavement was subject to excessive maintenance costs due to lack of proper subdrainage structures. Before proceeding with the modernization of the cross section of high-crowned pavements and the application of armor coat or other surface treatment, it was found necessary to install suitable drainage. Proceeding with the program as laid out, it is expected that by the fall of 1943, 1,000 miles of the 1,447 miles of older type pavement will meet present-day requirements as a result of drainage correction and surface modernization.

The program of modernization now proceeding on the older Connecticut highways will bring these roads up to the standard required by the War Department with the exception of the 10-foot shoulder width requirement. However, the subdrains are so located that the 10-ft. area is stabilized.

Preliminary investigation.—A preliminary study of underdrain requirements disclosed a few localities where it was known that underdrains had been installed previously. In spite of this installation, the pavement was subject to frost boils and break-up or bad ice conditions. Investigation of these locations indicated several causes of failure of the under-drainage to function.

(1) The flow line of the drain was placed too high to intercept the ground water elevation. Obviously, such an installation fails to accomplish the results desired.

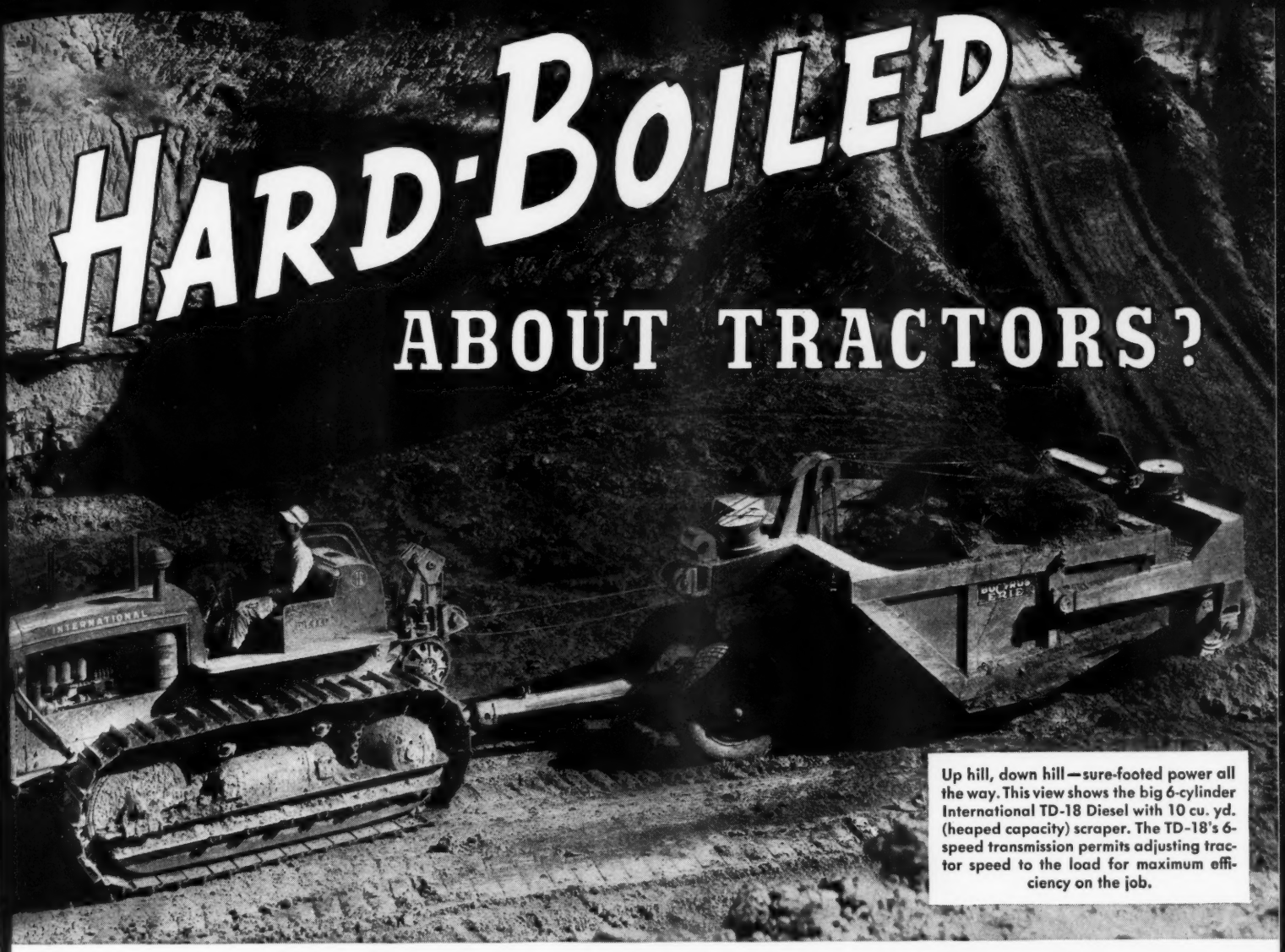
(2) Porous backfill on the old underdrains consisted of 1½"-2½" broken stone or screened gravel. In one location where a fine clay was encountered, the presence of water created a "soupy" material which proved difficult to control. This fine impervious clay filled the large voids in the stone and gradually sealed the tile drain. The underdrain pipe was laid with ends butted close together. The resulting joint between the ends being not over 1/16" wide, soon collected a deposit of clay, effectively sealing the pipe from the surrounding water. This was a common cause of failure, as disclosed by test pits dug on the old drainage lines.

(3) Pipe laid at a uniform depth of 3½" below pavement grade was found cracked or crushed. Presumably, this failure may be attributed to heavy loads applied either during construction or before complete stabilization of the roadway took place.

Method used to avoid failure of drainage.—Prior to making any installations under the 1940 program, test pits were dug at intervals of 200-300 feet to locate the ground water table. Based on the information obtained, the flow line grade of the new drainage was established in the impervious strata from 8" to 12" deeper than the water table. The point may be raised

Effect of lack of proper subdrainage.

HARD-BOILED ABOUT TRACTORS?



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† "Works fine," says the operator of this TD-6 Diesel, owned by A. J. Diana, Massilon, Ohio. Shown here grading dirt to make new lawn.

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INTERNATIONAL Industrial Power

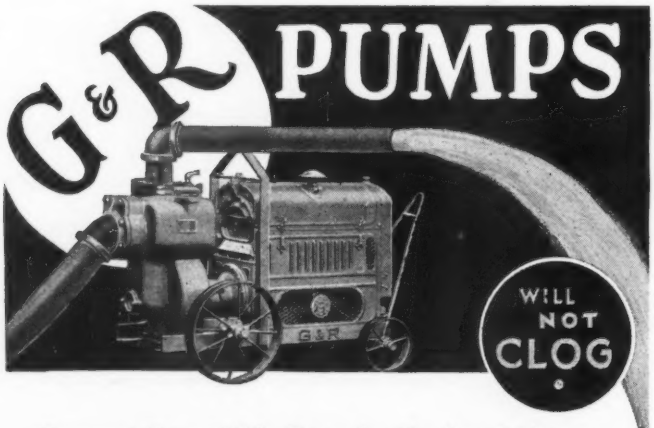
Placing drain below groundwater level.

that this ground water table varies according to the season of the year. This is true. Therefore, actual presence of ground water was not used as a criterion. The Field Engineer assigned to this work soon became experienced in determining the demarkation between pervious and impervious strata. He based his layout of the drainage on the data obtained from the test pits. It is interesting to note that as a result of the data so obtained, the flow line of the new subdrainage installations was lowered to an average depth 4 feet to 5 feet below the pavement grade. In some cases, a minimum of 3½ feet in depth was found to be sufficient.

Backfill and pipe. — It was hoped that the Department could utilize bank run gravel for pervious backfill, the material varying from coarse sand to stones of 2-inch maximum diameter. Unfortunately, the material available in Connecticut gravel pits proved to vary widely in quality. Therefore, the use of bank run gravel was abandoned. Screened gravel or broken stone ¼" to ¾" in size was adopted for use throughout the State. This material was available at pits or quarries at a cost of from 50c to $1.00 per ton loaded. The size of pervious material was adopted to conform to specifications for airport drainage as outlined in a report from the Aeronautics branch of the United States Department of Commerce.

The use of asphalt coated spiral perforated pipe was approved. The pipe is resistant to crushing, is available in long lengths and has positive ties between sections. The perforations in the pipe increase the filtration area over the area available on other types of pipe.

Location of perforations in relation to flow line.— The drainage work was started with a specification calling for perforations to be placed at the flow line of the pipe. The pipe was laid on top of a 3-inch bed of ½" gravel or broken stone. It was soon observed that undeground water flowed through the gravel base rather than into the pipe. Furthermore, soil formations in the State varied widely within short distances, due to glacial deposits. Adjoining sections of impervous clay and semi-pervious gravel resulted in underground water, which was collected by the underdrain in the clay section, being deposited in the gravel area without flowing to the outlet. This difficulty was corrected by installing the pipe with the perforations at the top of the pipe. The flow line of the pipe was lowered the diameter of the pipe. The lower one-third of the perimeter was backfilled with impervious mate-



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rial tamped into place. Thus the pipe served as a carrier to bring the underground water to the outlet.

Cleanout metal manholes with cast iron frame and cover, designed by the Department, were installed 250-300 feet apart and at all angle points. These manholes are installed for the purpose of inspection and cleaning.

Combination drainage.—In some locations, surface water drainage was a problem aggravated by unstable subgrade. This problem was solved by increasing the size of perforated pipe to 15″ or 18″ in diameter, as required. Standard catch basins were substituted for the cleanout manholes. In this manner, the use of a wide bituminous gutter was dispensed with, including the difficulty of controlling the flow of surface water for a long distance in the gutter line.

Costs.—The Bureau of Maintenance of the Connecticut State Highway Department performed the construction work described by Force Account with its own personnel. Gas shovels, ⅜-yd. capacity, with back-hoe attachments or cranes with clamshell buckets were used for approximately 95% of the work. This equipment was used on a rental basis; 55,445 linear feet of pipe was installed at a total cost of $171,445.55 or an average statewide cost per foot of $3.10. This applied to all soil conditions throughout the State. Individual job costs varied from $2.18 per linear foot for excavation in clay gravel to $7.32 per foot for 90% rock excavation. Our average cost of $3.10 per foot compares favorably with recent contract bid prices on comparable work, of $3.27 to $3.60 per linear foot.

Conclusion.—Experience acquired from the installation of 10½ miles of under-drain in 1940 brought out the fact that subsoil formations in the State of Connecticut vary widely in character. Soils were encountered consisting of silty clay which required tight sheathing in order to install the pipe. In other locations, clay gravel or rock containing water-bearing seams was encountered. With Connecticut conditions, it has been determined by experience that the stabilization of one mile of defective subbase provided complete stabilization for about eight miles of pavement. Thus, I believe eighty miles of pavement subject to excessive maintenance costs in former years, are now ready for surface modernization.

This material was presented by Mr. Turner as a paper before the 1941 meeting of the Association of State Highway Officials of the North Atlantic States.

Snow Removal by Gas Shovel in a Small City

By FRED L. NELLEY
Chairman, Street Committee, Waverly, N. Y.

To expedite snow removal from our streets, we built a snow bucket and attached it to our gas shovel. This bucket was 6′ x 6′ x 4′. The snow was plowed from the curb to the center of the street using an Austin-Western grader with attached plow. With this bucket, we loaded the snow into large dump trucks, loading these at the rate of one every two minutes. We had to haul the snow about one-half mile, and it kept seven trucks moving to keep the shovel busy. We found this very effective and inexpensive, and far better than plowing to the curbs and leaving the snow there to interfere with parking and business.

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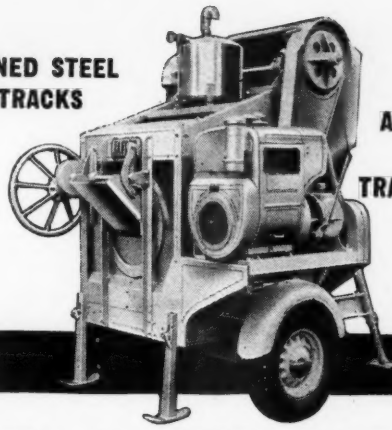
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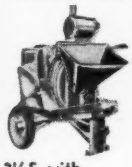
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Equipment for Evaluating Road Surface Roughness

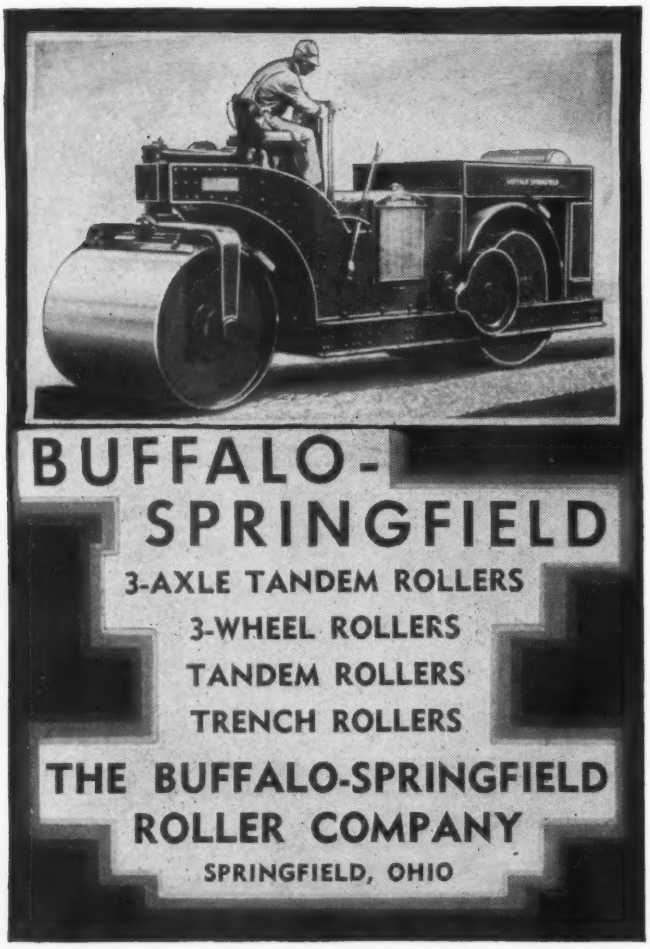
VARIOUS methods have been employed for determining the smoothness or roughness of road surfaces. Equipment developed for this purpose operated on the principle of the measurement of the vertical movements of a wheel suspension with respect to its supported frame. In earlier applications of this principle it was recognized that the difficulties that were encountered were caused by the use of apparatus that made use of the motor vehicle and its load as a component part. This led to an investigation by the Public Roads Administration of the use of a special vehicle capable of standardization in all of its parts.

After extensive experimenting, the Division of Tests of the Administration has developed a standardizable vehicle for evaluating road roughness which has the form of a semi-trailer, consisting of a rectangular frame within which is a single wheel equipped with a pneumatic tire. The axle of this wheel is attached to the center of two single-leaf springs, one on each side of the wheel. The ends of the springs are attached to the front and rear cross members of the rectangular frame through ball bearing fixtures. At the front of the frame is a tongue for connection with the towing vehicle. Over the wheel there is a cross-frame or bridge on which the integrator unit is mounted and to which the pistons of two dash-pot spring-damping devices are attached.

The tire used is the 6.00-16-inch 4-ply balloon tire, which is mounted on a standard drop-center rim attached to a disk wheel. The frame is constructed of standard steel channels and may, theerfore, be exactly duplicated. It is rectangular in plan with heavy angle corner connections. The wheel is located centrally in the frame and over the wheel is the steel frame or bridge that carries the instruments and provides connections for the damping devices. At the forward end of the frame a pair of channel sections, forged to form a Y-shaped tongue, is attached to the frame. The towing connection is provided at the end of this tongue. A molded lead counterweight is secured to the forward end of the frame, its mass and location being such that the center of percussion of the entire trailer, when suspended from the towing hitch as a pendulum, is in the plane of the axle. The hitch to the towing vehicle maintains the trailer in an upright position but provides freedom of motion by means of a universal or gimbal joint device than can be attached to any towing vehicle. The gross weight of the entire apparatus is 740 pounds.

The vertical movements of the wheel with respect to the frame are measured by a newly designed, overrunning clutch integrator with improved operating characteristics. Many hundred miles of operation without mechanical failure indicate adequate mechanical design. The device is simple to operate and the data are obtained rapidly with it.

It is believed that the underlying principle as a



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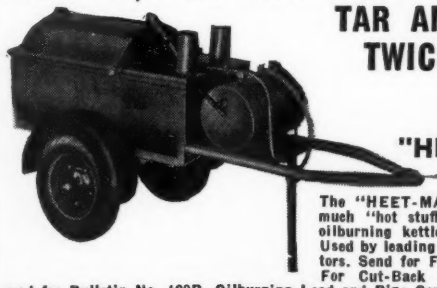

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means for indicating the relative roughness of road surfaces is sound and that the present equipment is superior to that developed earlier in two important respects: First, the use of a special vehicle has removed the uncertainties of vehicle operation that were always present when an automobile was a component part of the measuring apparatus; and second, the entire equipment is so designed that it can be exactly duplicated and, to this extent, the equipment is standardizable.

Plans and specifications for this apparatus will be sent by the Administration to anyone wishing to construct this type of roughness indicator.

It would appear that there are several fields of usefulness for equipment of this kind. Since the apparatus is constant in its performance, it permits of periodic surveys of surface condition that will give quantitative data on the roughness of the various pavements in a highway system. Thus, the surfaces of two pavements can be compared month by month for one or more years. Data so obtained would show the need for and result of surface maintenance operations. With means for evaluating surface roughness available, the interest of construction and maintenance crews can be aroused and a desirable competitive spirit stimulated.

Greater Uniformity in Truck Load Limitations

Special automotive taxes, fees and diversion of highway funds to non-highway purposes are receiving a major share of attention in the 43 state legislatures meeting in regular sessions this year. Laws governing the sizes and weights of motor vehicles, regulating commercial highway transportation and motor vehicle reciprocal agreements, as well as highway financing, are of major importance among the 251 new statutes listed in the survey.

Paramount among laws enacted this year regulating sizes and weights of motor vehicles is the Texas statute repealing the 7,000-pound load limit and substituting a gross weight of 38,000 pounds for trucks.

Tennessee increased its gross weight limit from 24,000 to 30,000 pounds. The North Dakota gross weight was increased from 35,000 to 40,000 pounds. Washington raised the gross weight of two-axle vehicles to 28,000 pounds.

A law was adopted in Georgia which increases the allowable weight per axle from 17,600 to 18,000 pounds. It repeals the former maximum weights, and substitutes the formula recommended by the American Association of State Highway Officials. The law also increases the length of single trucks from 30 to 35 feet.

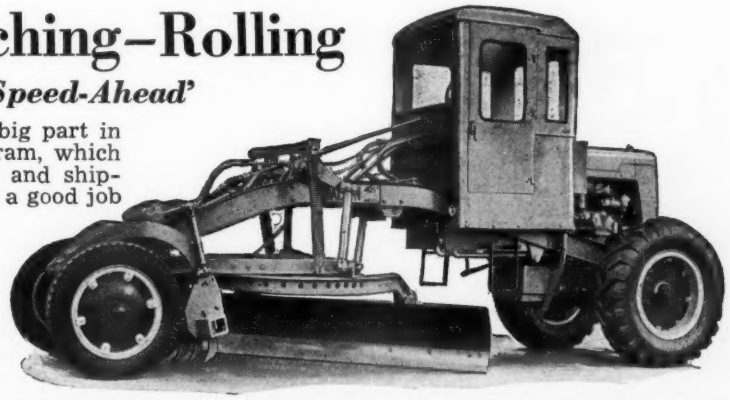
The Maryland legislature adopted a measure to increase gross weights of motor vehicles, fixing the weight per axle at 22,000 pounds. Under the formula adopted, the top weight will be between 60,000 and 70,000 pounds for trailer combinations.

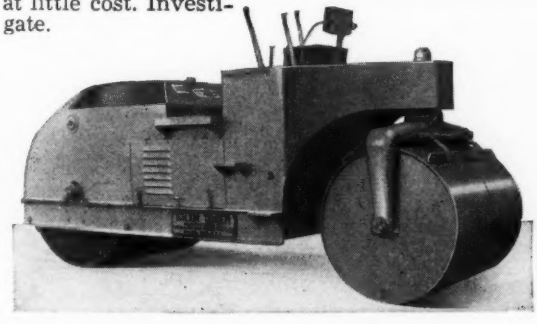
The Indiana legislature repealed the 40,000 pound maximum weight and substituted a formula permitting a maximum gross weight of approximately 56,000 pounds on semi-trailer and trailer combinations. Single four-wheel units, granted an increase in length from 33 to 36 feet, may weigh approximately 36,000 pounds. The Indiana truck-tire tax and the Tennessee mileage tax were repealed.

Tamping–Blading–Ditching–Rolling

Galion Units Built for 'Full-Speed-Ahead'

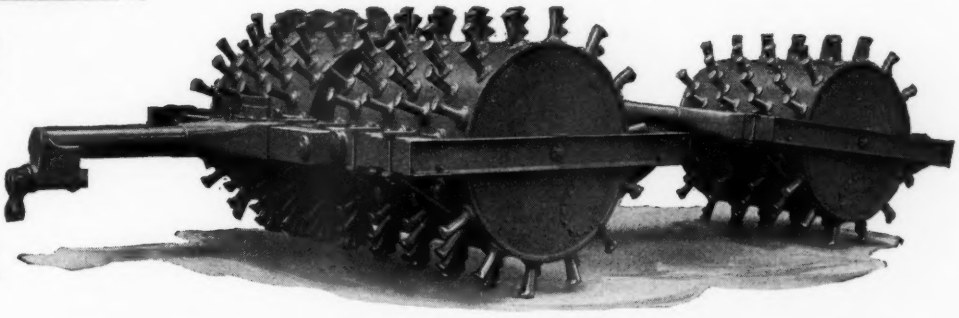
Galion rollers, graders and spreaders are playing a big part in the Highways for Defense part of the National program, which includes roads in and around cantonments, airports and shipyards. Galion road building and maintenance units do a good job at little cost. Investigate.





Galion No. 401 motor grader (above)—a light weight unit for general maintenance work. 31 HP, 4-cylinder International engine. Bulletin No. 255. Galion sheepsfoot roller (below) for tamping earth fills. Any number of arrangements possible. Also 3-wheel rollers in weights from 6 to 12 tons—diesel or gasoline engines.

Galion tandem roller (above) with weight variable from 5 to 14 tons—two models and three sizes. Gasoline or diesel power—hydraulic steering. For precise compaction of road building material—get a Galion tandem.



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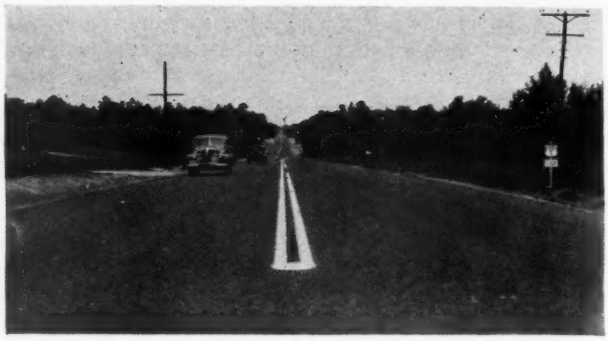
The Galion Iron Works & Mfg. Co., Galion, Ohio

A section of Route No. 1 before reconstruction.



The same section after reconstruction.

Rebuilding Old Roads in Virginia's Primary System

By T. F. LOUGHBOROUGH
Construction Engineer, Dept. of Highway of Virginia

PRACTICALLY all roads of much importance in Virginia's primary system have been improved to the extent of having some type of surface which makes them an all-year-road, but with the improvement in the automobile and the increase in truck traffic, a number of the older roads are now inadequate. Consequently, much of the highway construction of today is the rebuilding of existing roads which brings out very conclusively the point that too much consideration cannot be given to the alignment and grades in establishing a highway. When a road is once built on proper alignment and grades, with bridges of sufficient width and strength, it is not such a costly matter to increase the pavement to a higher standard; but when the grades have to be changed and curves decreased, then the old road loses most of its value and, except for the loss of the value of the right of way, the new or reconstructed road might as well be put on another location, thereby avoiding inconvenience to traffic during construction.

Fortunately in the Eastern part of this State the more important roads were originally constructed on fairly good alignment and grades and in most cases it is these that are being improved. Usually the reconstruction or improvement consists of widening or placing additional surface on top of the existing one, and this type of construction progresses rather fast. As an example, on Route 1 (which is a quite heavily travelled road) a project of 4.4 miles was let and work started September 16th. The work consisted of widening an old 18′ concrete pavement by adding 12′, making a total width of 30′ with sheet asphalt top over entire width. This particular project is through rather a hilly section and the excavation for the widening amounted to approximately 12,000 cubic yards per mile; in addition to which 14,000 cubic yards of subgrade treatment material was required, the widening of drainage structure and other incidental items. The grading was completed, except final dressing, by October 10th. The concrete pavement was started October 7th, and completed October 31st. The sheet asphalt will not be put on until next spring. The cost of the project is at the rate of $43,000 per mile and of this, $16,000 per mile is in the sheet asphalt including nonskid top.

Another project is on Route 460 from Petersburg to Suffolk, which also carries a fairly heavy traffic, principally heavy trucks. The road was originally constructed as an 18-foot soil surface and, with the increased traffic, the maintenance costs have become so high that it is imperative that it be converted into one of a higher type. In order to get as much salvage value as possible out of the existing road, it was decided to construct two concrete lanes of 11 foot width, one on each side of the old soil surface and on more modern grades. After the two lanes have been completed, the soil is brought to a true surface conforming to the concrete, and surface-treated. This gives two concrete running lanes, divided by 18′ of surface-treated soil which is used for passing. The general appearance is very pleasing and provides a safe road to travel.

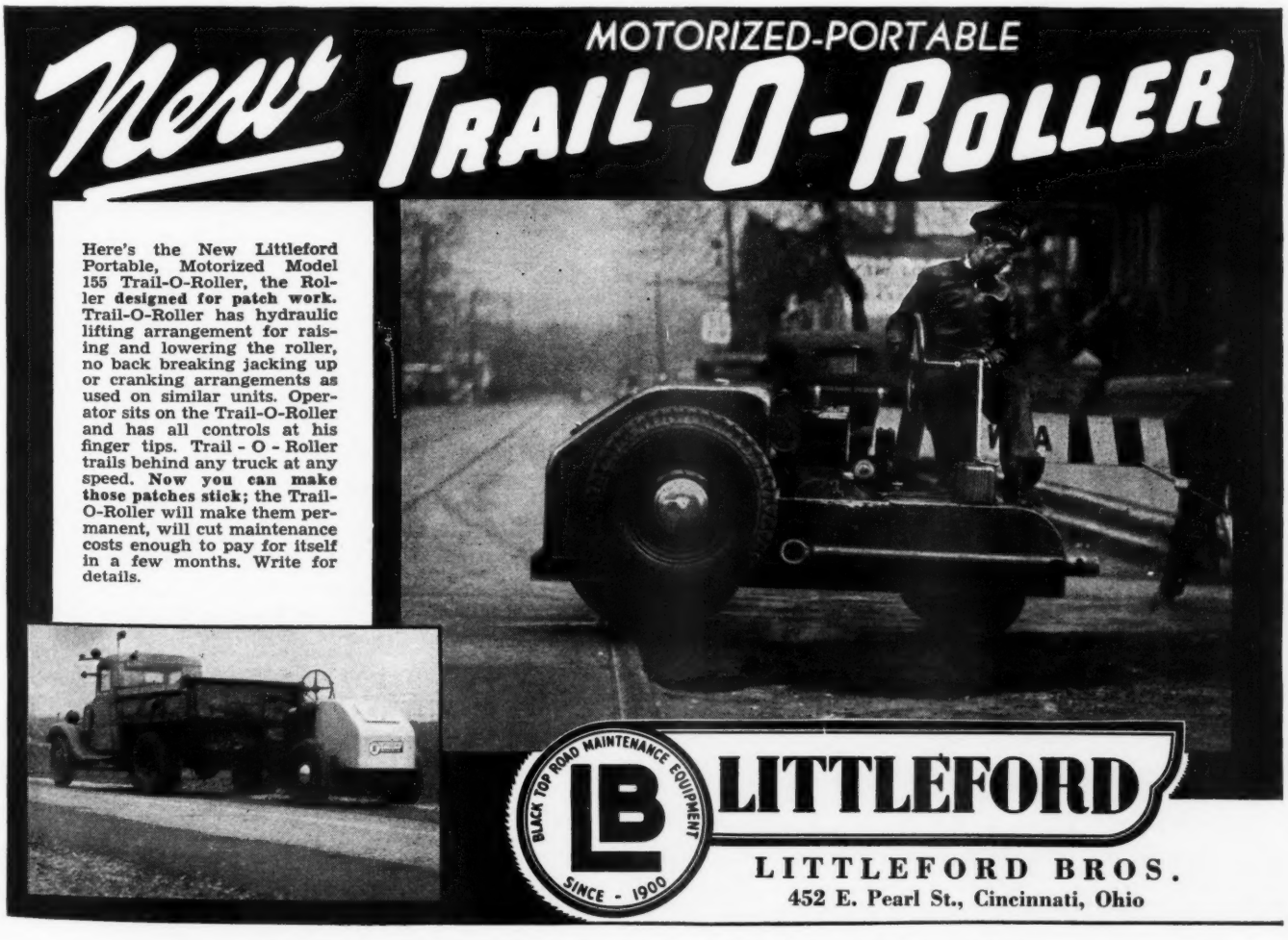
Rebuilding roads in Virginia.

A number of projects have already been completed on this route, the most recent being 4 miles in length with only 24,237 cubic yards of excavation and 9,000 cubic yards subgrade treatment material. Work was commenced June 24th, and grading was started soon after this and completed about September 1st. Concreting on the first lane was started August 1st, and both lanes completed September 26th. No particular consideration was given to speed and the progress was about as would be expected on any project with equal quantities. Good progress can be expected on a project with such a design, and in addition, traffic was maintained at all times with very little inconvenience.

On other routes originally constructed of soil surface where the increase in traffic is not sufficient to warrant a type as high as concrete, 6-inch waterbound macadam is being used. The old surface-treated soil is not disturbed except to correct any weak places, these being dug out, 6-inch pipe drains installed and then backfilled with run-of-crusher stone mixed in with soil. The surface treatment of the soil is not disturbed, except as noted at the weak places, and the 6-inch macadam is laid directly on top. Many miles of soil roads have been reconstructed by this method and up to this time have proved quite economical and satisfactory. A project of this type now under construction is on Route 250, between Charlottesville and Richmond, 11.7 miles in length of 20 feet width of 6-inch macadam, with 93,675 cubic yards of excavation. (This yardage is somewhat high due to widening the shoulders and using very flat slopes on both cuts and fills.) Normal rate of progress on a project of this kind is about 4,000 lineal feet of pavement per week, but if desired it could easily be stepped up to a much higher rate, as the progress depends altogether on the production of the stone. The cost of this particular project, which is a fair average, including 10%, is $175,870, or at the rate of about $15,000 a mile. Included in this cost is clearing and grubbing, extension of bridges and culverts, excavation, macadam and mixed-in-place surface treatment, with other smaller items.

Road Roller Goes 60 Miles an Hour

The general idea of a 12-ton steam roller is that it is surpassed in deliberateness of motion only by snails, turtles and oxen; so when citizens of Salt Lake City saw the Street Department's roller rushing at them at a rate estimated to be 60 miles an hour, they were almost too surprised to run for their lives. As the daily paper reported it on March 26: "The wild ride started when the steamroller gears wouldn't mesh as Solt (the driver) began a descent down a steep hill. The brakes failed to slow the huge machine, and when Solt took it through an intersection crowded with buses, cars, and school children, it was averaging 60 miles an hour. Desperately seeking to slow down, Solt steered the roller onto a parking strip. It mowed down electric poles like match-sticks. When he entered a clear stretch, Solt wrenched the steering wheel and jumped. The roller overturned, skidding 96 feet before it came to a halt." Solt suffered minor injuries.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New TRAIL-O-ROLLER
Here's the New Littleford Portable, Motorized Model 155 Trail-O-Roller, the Roller designed for patch work. Trail-O-Roller has hydraulic lifting arrangement for raising and lowering the roller, no back breaking jacking up or cranking arrangements as used on similar units. Operator sits on the Trail-O-Roller and has all controls at his finger tips. Trail - O - Roller trails behind any truck at any speed. Now you can make those patches stick; the Trail-O-Roller will make them permanent, will cut maintenance costs enough to pay for itself in a few months. Write for details.
BLACK TOP ROAD MAINTENANCE EQUIPMENT
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SINCE - 1900
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LITTLEFORD BROS.
452 E. Pearl St., Cincinnati, Ohio

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Various technical tests and analyses, however important, simply forecast performance expectancy. *Only* actual use can prove performance.

The more than 30 years *in-the-ground* record of GOHI pipe furnishes indisputable evidence of the enduring qualities of GOHI Pure Iron-Copper Alloy — the longest-lived, low-cost ferrous culvert metal. To use GOHI pipe is to enjoy the profitable advantages of complete dependability, extra years of wear, and freedom from costly upkeep.

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350 National Defense Airports Under Construction

WPA airport construction projects are under way at 248 sites, having been certified by the Secretaries of War and Navy as important to National Defense, and 88 more have been approved, while work was recently completed on 8. More than 60,000 men are employed on these projects, which are estimated to cost about $150,000,000; the authorized work including every aspect of airport facilities, from grading and runway paving to constructing buildings and installing utilities and field lights.

To speed airport development, the work week of WPA employees has been increased from 30 to 40 hours a week to 48 and the time for obtaining approval of projects submitted by local governing bodies has been shortened. The Civil Aeronautics Administration recently provided nearly $10,000,000 to prevent delay at 86 of the certified airport sites where additional funds were needed.

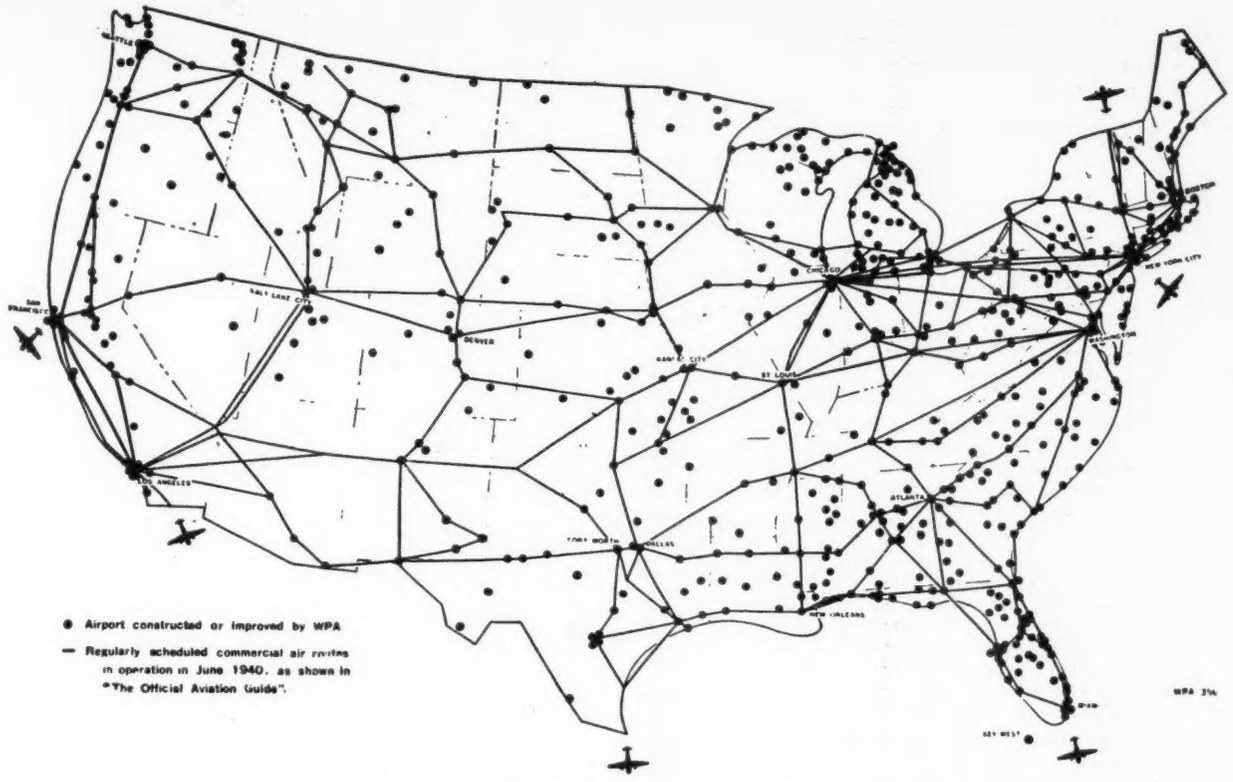
Since its inception WPA has provided more than 200 new landing fields and improved several hundred others, and is now expanding many of these for military use. In fact, most of these airports are now in actual or projected use by the army in connection with airplane production and pilot training.

The program calls for expenditures, in WPA and sponsors' funds, of $13,681,000 in Florida, $11,834,000 in California, $8,929,000 in Maine, $7,981,000 in Pennsylvania, $7,138,000 in Washington State, $6,791,000 in Illinois, $4,922,000 in the District of Columbia, $4,618,000 in Alabama, $4,138,000 in Colorado, $4,117,000 in New York, $4,039,000 in Texas and $4,004,000 in New Jersey.

The largest allocations of WPA funds in the current program, by sites, include: Scott Field (Army), Belleville, Ill., $3,147,000; Philadelphia Municipal Airport, $2,212,000; Lowry Field (Army), Denver, $2,116,000; Snohomish County Airport, Wash., $2,084,000; Des Moines City Airport, $1,656,000; Baltimore Municipal Airport, $1,542,000; Stout Field (National Guard), Indianapolis, $1,212,000; McDill Field (Army), Tampa, Fla., $1,159,000; St. Paul Munipical Airport, $1,115,000; Naval Air Station, Jacksonville, Fla., $1,105,000; Ohio County Airport, Wheeling, W. Va., $1,083,0000; City Airport, Albany, Ga. $1,079,000; Caribou Municipal Airport, Me., $1,022,000.

Estimated Cost of WPA and Airways Projects Approved by the President for Operations and Certified as Being Important for Military or Naval Purposes*; by States as of February 20, 1941.

WPA Region and State	*Number of Airport Sites*	*Estimated Cost from WPA and Sponsor's Funds †*
GRAND TOTAL	344	$147,935,202
CONTINENTAL UNITED STATES	328	141,663,688
REGION I	44	17,437,696
Connecticut	8	2,880,689
Maine	17	8,929,195
Massachusetts	11	3,252,066
New Hampshire	4	1,508,417
Rhode Island	1	394,011
Vermont	3	473,318



Map of the United States showing, by dots, the airports that have been constructed or improved by WPA.

Handles ALL Striping Jobs!
Here's a simple, compact machine marker that's capable of handling all types of striping jobs:
Street Centerlines
Parking Lines
Cross Walks
Safety Zones
Playgrounds
Airports
Football Fields
Tennis Courts, Etc.
In addition, this versatile machine comes in handy as an all-purpose paint sprayer for painting curbs, traffic signs, park benches, poles, guard rails, bridge abutments, fences, etc. Used by cities all over the country. Write for literature.
MEILI-BLUMBERG CORP., Box PW-5 NEW HOLSTEIN, WISCONSIN
TWO TYPES
Hand propelled model (shown here) and self propelled type that lays down traffic lines up to 15,000 feet per hour. Easy, one-man control. Practically no upkeep.
STREET MARKER
A3294-½ H-R

When you need special information—consult the *classified* READER'S SERVICE DEPT., pages 63-65

REGION II	33	23,616,183
Delaware	—	—
District of Columbia	4	4,922,254
Maryland	3	2,591,671
New Jersey	7	4,003,948
New York—Total	11	4,117,319
New York City	1	212,862
New York (Excl. NYC)	10	3,904,457
Pennsylvania	8	7,980,991
REGION III	80	24,862,627
Florida	45	13,680,550
Georgia	8	3,985,997
Kentucky	3	2,344,021
North Carolina	8	2,041,819
South Carolina	7	679,671
Tennessee	1	174,596
Virginia	8	1,955,973
REGION IV	22	15,097,595
Illinois	3	6,790,776
Indiana	2	1,347,505
Michigan	8	1,553,293
Missouri	2	564,924
Ohio	5	2,078,498
West Virginia	2	2,762,599
REGION V	24	9,819,978
Iowa	3	2,334,025
Kansas	4	845,071
Minnesota	4	2,367,920
Nebraska	2	812,630
North Dakota	4	888,677
South Dakota	3	177,260
Wisconsin	4	2,394,395
REGION VI	40	16,891,182
Alabama	9	4,617,847
Arkansas	1	552,989
Louisiana	5	3,201,805
Mississippi	4	2,369,063
Oklahoma	5	2,110,975
Texas	16	4,038,503
REGION VII	32	15,162,569
Colorado	3	4,138,397
Idaho	3	300,553
Montana	6	810,398
New Mexico	3	946,548
Utah	3	1,569,314
Washington	12	7,137,591
Wyoming	2	259,768
REGION VIII	53	18,775,858
Arizona	1	803,861
California—Total	33	11,834,330
Northern California	20	5,884,998
Southern California	13	5,949,332
Nevada	3	650,145
Oregon	16	5,487,522
TERRITORIES	16	6,271,514
Hawaii	7	2,149,842
Puerto Rico	6	3,343,221
Virgin Islands	3	778,451

* Certified by the Secretary of War or the Secretary of the Navy.
† Includes WPA funds allocated for projects operated by other Federal agencies but does not include Federal Agency funds for such projects.

Prisoners of War for Highway Work

A woman member of the city council of Pretoria, South Africa, has suggested that the government furnish prisoners of war for constructing sidewalks in that city, as a "good way of improving them at reasonable cost to the rate payers." Another woman member asked that all footpaths be cleaned of grass at once. The "South African Municipal Magazine," authority for the above, mentions no action by a male member of the city council. Apparently women "run things" even more in that country than in this.

DUAL PRIME PUMPS!
25% FEWER PARTS
4-CYCLE ENGINE
NEW LIGHTWEIGHT MODEL!
2" Weighs 92 lbs.
3" Weighs 95 lbs.
The most useful Centrifugal ever designed for municipalities, fire departments and a wide range of public works use. Has exclusive dual prime action . . . doubly fast . . . doubly sure. Non-clogging design. Easy to transport. Capacities up to 15,000 G.P.H.!
A COMPLETE LINE OF MODERN CENTRIFUGALS!
Sizes from 1½" to 10"! Get new CMC Pump Bulletin!
CONSTRUCTION MACHINERY CO.
WATERLOO, IOWA

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A Suggested Solution of the Sanitation Problems at an Air Base Garrisoned by 4,000 Men

By A. E. STILSON
President, Morse Boulger Destructor Co.

Sewage Treatment

THERE will be from 70 to 100 gallons of sewage per day per man. The sewage will be fresh and if care is taken to keep out the grease and oil it should approximate average domestic sewage in character. For the purpose of this suggested solution the following characteristics are assumed:

70 gallons per capita per day = or 70 x 4,000 men = 280,000. gal.
.17 lb. of B.O.D. per capita per day = ± 680 pounds/day total.
Total dry suspended solids, 380 ppm = 0.25 pounds/capita.
Dry solids removed, 90%, leaving 38 ppm remaining in effluent.
Reduction in weight of dry solids by digestion, 40%.
Maximum hourly flow, 35,000 gal.
Duration of peaks, 1 hour.
Duration of flow, 16 hours of the 24 hours.
Hourly flow for 16 hrs. = 280,000 ÷ 16 = 17,500 gal./hr.
Hourly flow for 24 hrs. = 280,000 ÷ 24 = 11,600 gal./hr.

Bar Screen.—Spacing between bar, 1"; slope of screen toward flow, 30°; velocity through the screen will be about 3¼ ft. per second, using ¼-inch bars 1¼ ins. on centers in a channel 12 ins. wide.

Grit Chambers.—Two parallel grit chambers are recommended. By experience it is known that ± 95% of all grit that will remain on a 65-mesh screen will be dropped in the chamber if an area of 25 square feet is allowed for each million gallons of 24-hour flow. In this case it will then be:

$$25 \text{ sq. ft} \times \frac{70 \times 4{,}000}{1{,}000{,}000} \times \frac{24}{16} = 10.5 \text{ sq. ft. of area,}$$

and the velocity through chamber is 1.0 ft./sec., whence each grit chamber will be 8" wide x 2' 5" deep x 16' long.

Measuring and Laboratory Equipment.—A flume type or self-recording measuring device is essential for good operation. Records should be kept of the flow and of general operations. The laboratory equipment should include: Sink, sample table, and drying oven; analytical balance; weighing table; desiccator; pH and chlorine comparator; Imhoff cones; Bunsen burner; B.O.D. bottles; graduated cylinders; Jackson turbidimeter; Gooch crucibles and holders; evaporating dishes; incubator; refrigerator; burettes; watch glasses; graduates; stands; beakers; pipettes; flasks; sampling bottles, etc.

Grease Removal.—Grease and scum will be heavier than in normal domestic sewage and a grease chamber with scum board will be valuable immediately following the grit chamber. The detention period should be 10 minutes at the peak of 35,000 gal./hr. flow. The depth should not exceed 2' 6" with a 12" freeboard. A small turbo-blower or compressor operating at 22 to 24 oz. pressure, supplying 0.1 cubic feet of air per gallon through diffuser plates in the tank or 35 cfm will serve adequately. The scum should be allowed to flow off into a trough and then to a scum and grease sump for incineration.

The Treatment Plant.—A Clarigester is recommended as the primary treatment unit, to be followed by a biofilter. Details of these units have been worked out, but inasmuch as recommendations on the design of both the Clarigester and the biofilter were made in the March issue of PUBLIC WORKS (for an airport with 2,500 men) these will not be repeated here. Provision should be made, in dry areas, to return the effluent to the drainage system for subsurface irrigation, as already described.

Oil and Grease Disposal.—The oil and grease from hangars, hard surfaced runways, ramps, aprons, motors, etc., must be kept out of field drains and the sewerage system. It is suggested that soapy, oily, water, from washing down floors be led through grease traps and then into dry well sumps at some distance from any water supply, sewers or field drains. The crank case oil and engine greases provide a good fuel and should be used as such. They should not be used for laying dust; they may create a fire hazard, may ruin the turf and will eventually find their way into the drains.

Designing the Incinerator

In designing an incinerator for an airfield to serve about 4,000 men, use can profitably be made of some of the by-products of sewage treatment. Adequate modern sewage treatment equipment should be installed, as described in the March issue. If a heated digester (or Clarigester) is a part of the treatment plant, this should yield from 2,800 to 4,000 cu. ft. of gas per day, representing about 2,000,000 heat units. In addition to this, there will be heat values in the sludge, in the garbage, and also in rubbish and screenings, and possibly in the waste oil.

If the flow of sewage is 280,000 gallons per day, and it contains 380 p.p.m. of suspended solids, of which 90% are removed by complete treatment; and these solids are reduced about 40% in the digester, there will be 0.28 x 380 x .90 x 8.34 x .60 = 480 lbs. of dry sludge a day; and if this is, in reality 95% water and 5% solids, there will be nearly 10,000 lbs. of wet sludge per day. If this is dried to 60% moisture it will burn and in burning will release about 3,000,000 heat units.

In addition there will be from 4,000 men, about 2 tons of garbage and at least a ton of rubbish per day. These wastes will contribute heat values of importance. There will be wet screenings and grease, and perhaps crank-case oil. The incinerator can destroy all of these wastes, and can do it economically and without odor. If necessary or desirable, it also can be utilized to destroy other combustible wastes such as grass clippings and tree trimmings.

Summarizing the total known wastes to be destroyed, we have:

(a) Garbage, 4,000 lbs. per day, with 65% moisture content.

(b) Rubbish, 2,000 lbs. per day, with 10% moisture content.

(c) Sludge, 1,200 lbs. per day, with 60% moisture content.

(d) Screenings and grease, 400 lbs. per day, 90% moisture content.

(e) Gas from digester, 3,000 cu. ft. per day (average).

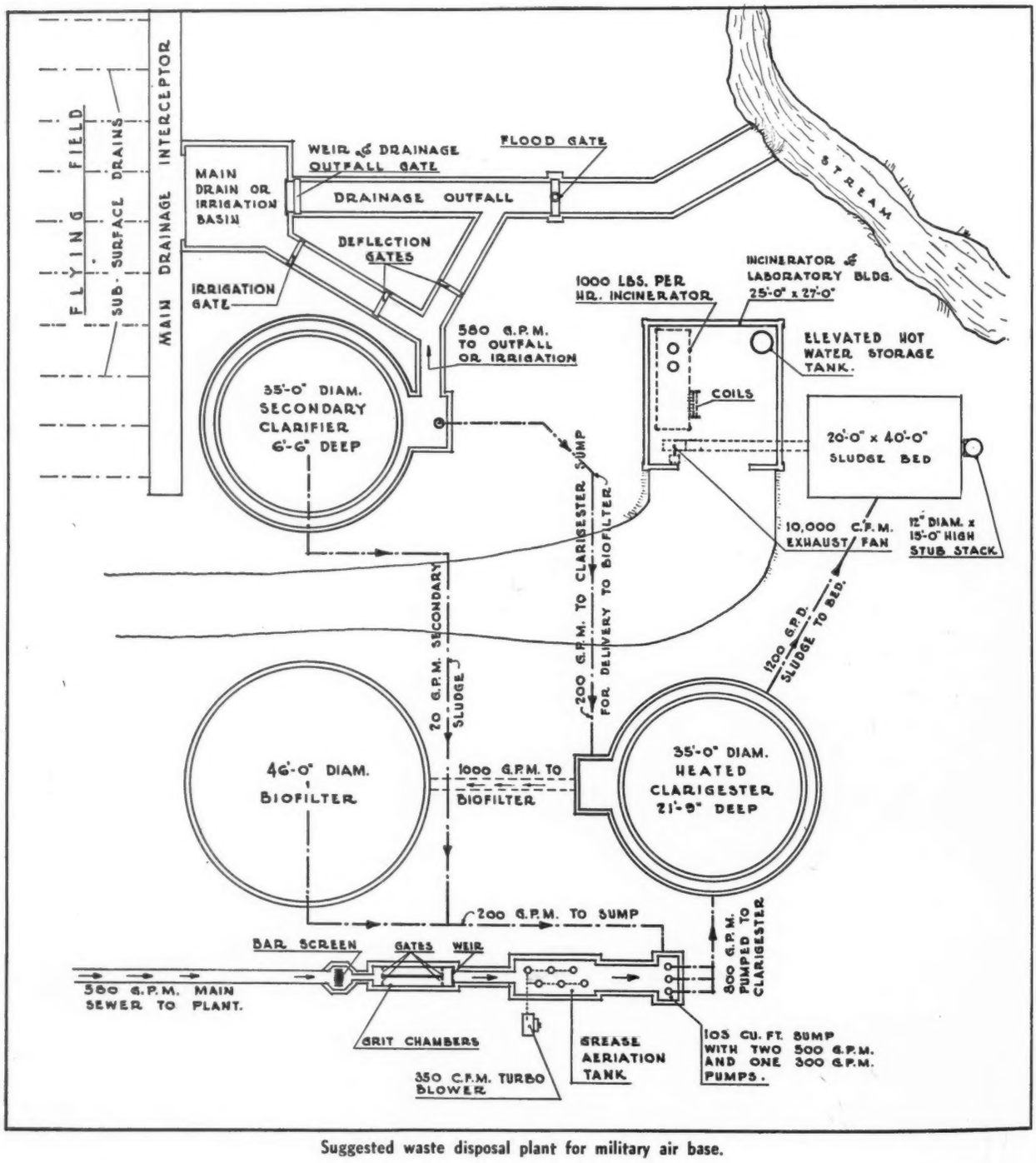
(f) Crank-case oil and other combustible wastes, amount unknown.

An analysis may be made of the heat values of each of these elements, as follows:

Substance	*Ash*	*Water Content*	*Combustible*	*Heat Value b.t.u.*
Garbage	5% or 200 lbs.	65% or 2400 lbs.	30% or 1200 lbs.	9,600,000
Rubbish	10% or 200 lbs.	10% or 200 lbs.	80% or 1600 lbs.	12,800,000
Sludge	15% or 180 lbs.	60% or 720 lbs.	25% or 300 lbs.	3,000,000
Screenings	5% or 20 lbs.	90% or 360 lbs.	5% or 20 lbs.	18,000
Gas	——	——	100%	2,100,000
Total 8-hr. day	600 lbs.	3680 lbs.	3120 lbs.	27,518,000
Total per hour	75 lbs.	460 lbs.	390 lbs.	3,440,000

The computations to determine the heat requirements for combustion are interesting. Based on maintaining an hourly heat balance of 1,250° F from 0° F, they are as follows:

The heat required to raise the 460 pounds of water in the above table to 212° F amounts to 460 x 212 x 1, or 98,000 b.t.u. To convert this water to steam requires 971 b.t.u. per pound of water, or 460 x 971 = 450,000 b.t.u. To raise this steam from 212 to 1,250° F requires 460 x 0.48 x 1,038 = 230,000 b.t.u. To raise the temperature of the ash to 1,250° F, requires 75 x 0.19 x 1,250 = 18,000 b.t.u. To raise the air needed for combustion, and the combustible material to 1,250° F, requires 390 x 19 x 0.25 x 1,250 = 2,300,000 b.t.u. To raise the gas and air for combustion to 1,250, requires (3,000 x 9 ÷ 13) x .24 x 250 = 125,000 b.t.u. A radiation loss of 150,000 b.t.u. should be allowed. The summary of b.t.u. values required for combustion are then:


FLYING FIELD
SUB SURFACE DRAINS
MAIN DRAINAGE INTERCEPTOR
MAIN DRAIN OR IRRIGATION BASIN
WEIR & DRAINAGE OUTFALL GATE
FLOOD GATE
DRAINAGE OUTFALL
STREAM
DEFLECTION GATES
IRRIGATION GATE
1000 LBS. PER HR. INCINERATOR
INCINERATOR & LABORATORY BLDG. 25'-0" x 27'-0"
580 G.P.M. TO OUTFALL OR IRRIGATION
ELEVATED HOT WATER STORAGE TANK.
COILS
35'-0" DIAM. SECONDARY CLARIFIER 6'-6" DEEP
20'-0" x 40'-0" SLUDGE BED
10,000 C.F.M. EXHAUST FAN
12" DIAM. x 15'-0" HIGH STUB STACK
200 G.P.M. TO CLARIGESTER SUMP FOR DELIVERY TO BIOFILTER
1200 G.P.D. SLUDGE TO BED.
20 G.P.M. SECONDARY SLUDGE
46'-0" DIAM. BIOFILTER
1000 G.P.M. TO BIOFILTER
35'-0" DIAM. HEATED CLARIGESTER 21'-9" DEEP
200 G.P.M. TO SUMP
BAR SCREEN
GATES
WEIR
580 G.P.M. MAIN SEWER TO PLANT.
800 G.P.M. PUMPED TO CLARIGESTER
GRIT CHAMBERS
GREASE AERIATION TANK
105 CU. FT. SUMP WITH TWO 500 G.P.M. AND ONE 300 G.P.M. PUMPS.
350 C.F.M. TURBO BLOWER

Suggested waste disposal plant for military air base.

To vaporize the water and raise the steam to 1250°	778,000 b.t.u.
To raise the ash temperature	18,000 b.t.u.
To raise the combustible material to 1250°	2,300,000 b.t.u.
To raise the gas and air to 1250° F	122,000 b.t.u.
Radiation loss	150,000 b.t.u.
Total heat required	3,368,000 b.t.u.

Since there are available 3,440,000 b.t.u. per hour without burning waste oil (which will contribute 140,000 b.t.u. per gallon burned) or other combustible matter, there is a favorable heat balance of 72,000 b.t.u. per hour. If no oil is used, the temperature will be about 1,250° F, which is satisfactory.

Design of Incinerator

On this basis, the incinerator may be designed for 1,000 lbs. per hour and a volume of heat release of 3,500,000. Giving proper values to the various elements there should be provided about 310 cu. ft. of furnace volume.

If the water to heat the digester is supplied by the incinerator, which is the most desirable method, allowance must be made for this. Heat computations should be carried out in detail for this, but a rough estimate of the water required is 10 gallons per minute at 125° F. If this is heated in the incinerator to 212° F it should be reduced in temperature before going to the coils in the digester by the addition of cooler water to the desired temperature. With allowance for heat losses in piping, and allowing also for a hot water storage tank (with incident loss of heat by radiation) required by the fact that the incinerator operates only 8 hours a day, about 50 cu. ft. of water per hour must be heated, which is equivalent to a requirement of about 410,000 b.t.u. per hour. The heating surface required is, after allowance has been made for the heat content of the return water from the digester, 410,000 ÷ 3½ (1,250 — 212) = 122 sq. ft.

Since there are available about 3,440,000 b.t.u., and the utilized heat represents only about 578,000 of this, the flue gases going to the chimney will contain nearly 3,000,000 b.t.u. per hour for 8 hours, and they will be at a temperature of 1,100° to 1,200° F. A chimney is not desired at an airport, but flue gases at 1,100° to 1,200° cannot be handled economically by an induced draft fan. Therefore the gases must be diluted by the addition of cold air. Roughly there should be added to the flue gases weighing ± 10,000 lbs. per hr. about 20,000 lbs. of cold air, which will reduce the flue gases at ± 1,100° F to about 300° F. Flue gases at 300° F may be handled economically by an induced draft fan. Also, if desired, such a fan can force these heated gases into a circuit over a sludge bed. There is enough heat in these diluted flue gases above the dew point to release about 1,000,000 b.t.u. per hour or to evaporate 2,000 lbs. of water in sludge per hour. There will be 1,200 to 2,000 gallons of sludge per day from an adequate plant serving an airfield such as discussed. This sludge will contain up to about 16,000 lbs. of water. In order to burn the sludge, about 14,800 lbs. of water must be removed. As shown, there is ample heat to evaporate 14,800 lbs. of water in 8 hours, and if the sludge is dried in 8 hours, bed space need be provided for only one day's production of sludge. If sludge is spread out to a depth of 4″, the bed area need only be 770 sq. ft. Therefore a sludge bed, if efficiently constructed, as in a metal pan, to utilize the heat, need be only 20 x 40 ft. in size. The flue gas may be passed either

"Give those 2-inch mains CAST IRON permanence, too!"

Engineers have exploded the old fallacy that 2″ mains for new sub-divisions are temporary—that's why they use

McWANE 2" CAST IRON PIPE

—the pipe they know will prove *rust-resisting* and *ever-lasting*.
—yet costs only a few *pennies* more per foot than short-lived substitutes.

With its modern factory-made joints McWane 2″ *cast iron* pipe can be laid faster and at less cost than any other pipe. Investigate!

Oversize THREADED Joint, *Like this* or PRECALKED Joint *"Just socket and calk"*

ALL SIZES 1¼" thru 12"

Sand Cast Inside and Outside
McWANE CAST IRON PIPE COMPANY
BIRMINGHAM, ALA. SIZES 1¼" THROUGH 12"

WHAT EVERY FILTER PLANT SUPERINTENDENT SHOULD KNOW ABOUT

Activated and Blackalum

❶ Question: What is ACTIVATED ALUM?

Answer: It is a most effective coagulant, containing 7% of acid-treated insoluble clay which provides a vehicle for distributing the alumina and acts as a physical nucleus for rapid floc formation—particularly in waters of low turbidity. (Activated exceeds A. W. W. A. Alum Specifications.)

❷ Q. What is DUSTLESS BLACKALUM?

A. It is Activated Alum, containing from 3% to 4% of powdered activated carbon with a phenol value of less than 25. It is quick-floc-forming, dustless, flexible, economical, and *possesses the remarkable ability to stabilize sludge, reduce chlorine demand and reduce taste and odors.*

❸ Q. Why should I insist on ACTIVATED or BLACKALUM?

A. Because, only with ACTIVATED can you get ACTIVATED'S RESULTS. These products are the result of painstaking research and development—*a combination which is giving water-treatment plants more and more efficient coagulation at lower and lower cost.*

❹ Q. What about PRICE?

A. ACTIVATED ALUM is sold within the very narrow limits of current market quotations for regular filter alums, while BLACKALUM, due to its activated carbon content, is only two dollars more per ton than STANDARD ACTIVATED ALUM.

❺ Q. What should I do NOW?

A. Send your next order to us—then watch us perform for you.

Activated Alum Corp.

Office: 5701 Pennington Ave., Baltimore, Md.
Works: Curtis Bay, Baltimore, Md.

When writing, we will appreciate your mentioning PUBLIC WORKS

over or under this pan, or both. The vapor so removed should be collected by a hood and blown to a point where its discharge will not cause nuisance. In fact it could be used for aeration in the grease tank, after which it should be discharged through a stub stack about 12 ins. diameter and 15 ft. high.

The steps outlined here, though applied to the design of a complete waste disposal unit for an airport, are equally applicable for any sewage treatment problem.

Bellingham's Water Works Improvements

By GEO. A. BROCK
Superintendent of Water Dept., Bellingham

Geo. A. Brock.

BELLINGHAM, Washington, in 1939 and 1940 spent about $450,000 in improving its water plant. It draws its supply from a lake, using about 20,000,000 gallons a day, from which water flows by gravity to all of the city except one high section. The improvements included a new tunnel, an intake pipe extending 1200 ft. into the lake, a pumping station, and a chlorination building which also houses screens and a laboratory.

The tunnel is 7,450 ft. long, excavated about 9 ft. bore and lined with concrete giving a finished tunnel 6 ft. 6 in. diameter with an almost flat bottom. The fall is one foot per thousand. Almost the full length was through solid rock that did not require any timbering, but where timbering was required steel sets were used. We ran into one place where there was trouble with quicksand and here the contractor excavated about 50 ft. in open cut, which was cribbed and straw used to keep out the sand. Only three shafts were used in the full length. Dump cars drawn by mules on a narrow-gauge track hauled the waste to the shafts.

The concrete was placed with a compressed air gun. Steel forms were used in units 90 ft. long that were moved once every day. The forms were oiled on the outside and left a very smooth surface. A copper expansion joint was used at every construction joint. The tunnel was built in 13 months by the contractor, Ben F. Sheldon of Spokane.

The intake was constructed by Croy & Lich Co., using 72 in. continuous wood stave pipe furnished by Brooks Lumber Co., both firms of Bellingham.

The pumping station has a pump floor at elevation 300, and contains two new Allis Chalmers pumps, one 350 gpm and one 600 gpm, which serve the hill district. The chlorination building is of reinforced concrete with a variegated colored wood shingle roof, built by C. A. Standen, local contractor. The first floor, elevation 310, contains chlorinators, ammoniators, control panels and laboratory. The second floor contains the operating equipment, two sets of Chain Belt revolving screens and the lime feed. Lime is stored in the third floor, elevation 330.

Geodetic, Topographic, General and Subsurface Mapping

(Continued from page 17)

3. Restoration and Monumenting Boundaries
   a. Section Line
   b. Urban
   c. Street and Road
   d. Block
4. General Mapping
   a. Street and Property Line
   b. Land Classification
   c. Tax Maps
5. Underground and Surface Structures
6. Cross Sections and Profiles
7. Riparian, Stream, and Hydrographic
8. Drainage and Flood Control

When project applications are submitted which appear to lack the proper continuity of operations, complete justification is requested from the sponsoring agency.

As the execution of engineering surveys and the collection of accurate map information are essential to any community development or long-range public planning program, the projects operated under the WPA program in this field are considered a valuable contribution to the general public. These surveys establish a basis for all future surveys, and the preparation of much needed maps afford the sponsoring agencies valuable factual information from which to plan future operations efficiently and economically.

Surveys and map information are, of course, important factors in the construction program. The need for such information is generally recognized as more acute because of the demands of a comprehensive defense program. It appears to have been the lack of preliminary surveys, plans, estimates, and layout surveys that constituted a "bottleneck" in the construction of airports. This is particularly true because the time element is now of primary concern. Local sponsors have not been able to supply the needed information with sufficient speed to cope with construction needs. This situation is being met with local and statewide projects to assist in supplying the needed preliminary information and for executing the layout surveys.

A large volume of data pertaining to roads that are designated as important for military purposes is available in the Public Roads Administration, and from the Highway Planning Surveys executed by WPA in cooperation with State Highway departments and the Public Roads Administration; but there is need for detailed data concerning secondary rural roads and routes considered as of military importance, and the access roads to military establishments.

For the U. S. War Department, WPA is now assisting in the preparation of maps for strategic, tactical, and fire-control purposes. This work consists of the revising of the U. S. Geological Survey's quadrangle sheets by the use of aerial photographs and other available information.

Other types of WPA projects sponsored by the War and Navy Departments consist of converting the plane coordinates for the positions of horizontal control to the Army Grid System; surveys for airports; surveys, plans, and specifications of emergency military structures; boundary, topographic, and utility surveys of Army and Navy Posts; and surveys for harbor defense.

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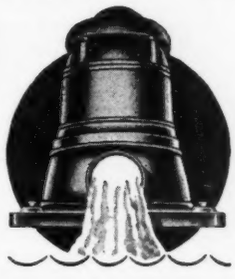
MORE WATER



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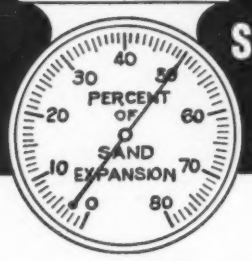

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Throughout this program considerable attention is given by WPA to training of personnel. Taking advantage of the opportunities afforded by the engineering survey program, persons with varying degrees of education and practical experience have been able to equip themselves so as to serve as assistants in private practice; and, in a number of instances, they have been able to direct similar work for the sponsoring of other agencies.

The geodetic control surveys are considered as the basic framework of the survey system. They not only afford a simplified means for executing supplemental surveys, but they provide the basic control necessary in the preparation of maps, and they establish a means of permanently preserving the locations of property boundaries in the field as well as in the public records.

The WPA has advocated the execution of such control in areas where it is not available, or is too widely spaced for convenient use by practicing surveyors or engineers. Projects of this type are now being operated in city and county areas as well as on a state-wide basis. Those operating on a state-wide basis are Alabama, Arkansas, Connecticut, Georgia, Iowa, Massachusetts, New Jersey, Oklahoma, Tennessee, and Virginia. Considerable work also has been done in Florida, Louisiana, North Carolina, and South Carolina.

Current engineering practice has established definite specifications pertaining to accuracy and spacing of each type of area involved. By applying accurate basic control surveys to present-day measurement of land, conclusive evidence is available which demonstrates the need of a high order of accuracy, and abandonment of the use of equipment and methods that have been outmoded. In all operations of this character, the use of the State-wide Plane Coordinate System is recommended and has been used, except in a very few instances where there has been some local controversy over its adoption on a state-wide basis. It has also been recommended that the North American Datum be adopted on all projects as a basis for the vertical control system. In this connection, it may be mentioned that urban areas formerly used as high as five different level datums before the work was initiated with the assistance of WPA.

Although aerial photographs are being used on many WPA projects, their principal use is in the preparation of tax maps, planimetric fire control maps for the U. S. Forest Service, building locations in urban areas, highway planning surveys, land-use maps and in the preparation of tactical maps for the U. S. War Department.

One of the most important occasions for the use of aerial photographs is the preparation of tax maps on a county-wide basis. This work involves the establishing of supplemental geodetic surveys for controlling the contact prints of the AAA which are on a scale of $1' = 1{,}666'$. The drainage and culture are plotted on the photographs by stereoscopic methods. A planimetric or base map is then made by radial-line method on a scale of $1'' = 1{,}600'$. The property deeds from record information are then plotted on a scale of $1'' = 660'$, using the enlarged aerial photographs of the AAA, in order to locate the property parcels in their relative position according to the deed description. The base map is then enlarged to $1'' = 800'$ in the rural areas, with all detail projected into its proper position; and then the aerial photographs containing the deed lines are projected on to this sheet. The map of the urban areas will be made on a final scale of $1'' = 50'$. This type of map is of the utmost

value to the sponsor, since it is of sufficient accuracy for computing taxable areas. In its preparation, many unlisted properties are found which result in an increase in the tax income to an amount many times greater than the cost of the survey.

The U. S. Forest Service sponsors projects to compile planimetric maps of National Forests by the use of aerial photographs with contact prints 1:20,000. The ground control consists of positions established by the U. S. Coast and Geodetic Survey, U. S. Geological Survey, and the sponsor. The scale of the final map is 1:31,680, and is plotted in fifteen-minute quadrangles. According to the opinion of the sponsor, these maps are invaluable for use in fire control, and also serve the general purposes of the Forest Service.

The location of buildings in urban areas has become increasingly important in the past five years. Field measurements were too costly to use in the mapping of building locations. The work is now done by the use of aerial photographs, which are usually enlarged to 1″ = 50 feet from a scale of 1″ = 600 feet. The locations of the buildings are then projected and traced on block maps, which are plotted from a combination of record and field survey information.

Measuring Germicidal Effectiveness of Chlorine

At present there are two accepted methods for determining available chlorine—the starch-iodide and the ortho-tolidine tests. But there are few data to show the significance of the available chlorine in terms of germicidal effectiveness, especially with solutions containing organic matter.

A few attempts have been made to correlate the germicidal action of chlorine with the oxidation-reduction potential. W. L. Mallmann and William B. Ardrey studied this subject at the Michigan Engineering Experiment Station and the experiments conducted and conclusions reached have been published as Bulletin No. 91 of the station. The conclusions are abstracted briefly below.

The oxidation reduction potential gave an accurate indication of the relative concentrations of germicidal action which may be expected between different concentrations of chlorine, both in the presence and in the absence of organic matter. On the other hand, neither the starch iodide nor the ortho-tolidine titrations gave such indications, either in the presence or in the absence of organic matter. Also, there was little or no correlation between the values obtained by these two titrations when organic matter was present. The chlorine demand of solutions containing organic matter is much higher as measured by the orthotolidine titration than by the starch-iodide.

With solutions containing identical amounts of chlorine at different pH concentrations, the oxidation reduction potentials indicate the increased germicidal activity with increasing acidity, whereas the starch-iodide and ortho-tolidine titrations gave the same values at different pH concentrations.

With the addition of increasing amounts of chlorine to solutions containing agar, a point was reached where the agar exerted an increased germicidal effect of that of solutions containing the same amounts of titratable chlorine but in the absence of agar.

From these results it would seem that the present methods of measuring available or germicidal chlorine are of questionable value, while that of the oxidation reduction potential is much more and more widely reliable.

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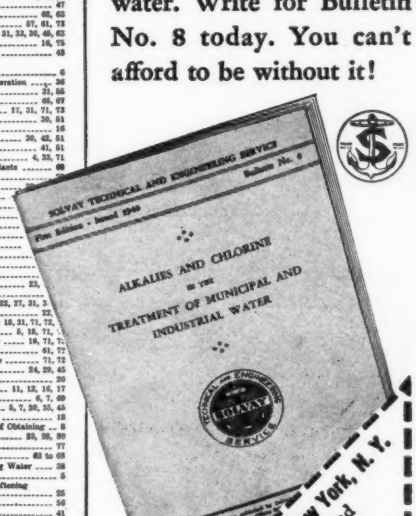
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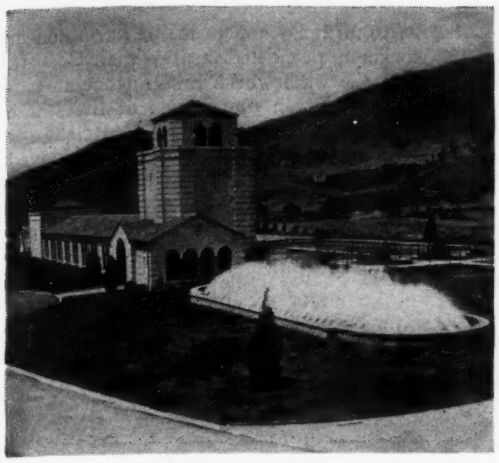


The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

HOW TO FIND ORIGINAL ARTICLES. Key letter at end of each digest refers to name of publication listed in bibliography at end of this section. Numeral indicates title of article.

A Photo-Electric Cell Colorimeter

The determination of residual chlorine is probably the most abused and most inaccurate of all the determinations made in the process of water purification and is the least understood. The author describes an instrument giving color density readings without intercomparison with a set of standards, thus making it possible to measure accurately the influence of such factors as treatment technic, temperature, time, concentration or reagents. This is a photo-electric cell colorimeter which "will give more accurate results in that it will eliminate the human element and in that its simplicity of operation tends toward greater accuracy. Then, too, it obviates the necessity for constant replacement of standards, as a single calibration for any solution holds indefinitely."[A47]

Pump Primer Causes Filter Binding

Tarboro, N. C., filters river water through three rapid sand filters. In March, 1940, when the filters were closed after a day's run, large amounts of air were released, so that sand bed shrunk at least 8 inches. Also, in the mixing basin air escaped at the water surface continuously. Several theories, such as presence of carbon dioxide, were disproved. Finally it was found that air approximating 111 cu. ft. per hr. was entering the pump suction through the priming assembly, the ribs in the accordion shaped diaphragm in the priming pot being loose.[F36]

Confirmatory Tests With 2% and 5% B.G.B.

Studies of 2% and 5% brilliant green bile as confirmatory media led to conclusions that the proportion of coliform organisms isolated from tubes that were shown, by one or more of three confirmatory procedures, to contain such organisms was greater when using the 5% medium than with the 2% medium. The 5% gave the smallest total cumulative error and is slightly superior in the inhibition of spore-forming organisms. Both 2% and 5% BGB media are very specific for the coliform group of organisms, and a great deal of time and labor could be saved by adopting either, and for examining most southern waters either could be used to advantage to replace the usual completed test.[A46]

Algae Control By Copper Sulphate

A reservoir at Summit, N. J., has a maximum depth of 11 ft., and generally much less than this in summer, and is troubled each year with algae of 18 or more species, chiefly Anabaena, Asterionella, Aphanizomenon and Mallomonas. Experience here indicates that three factors are of foremost importance in using copper sulphate for algae control: (1) knowing when to treat; (2) knowing how much chemical to use per treatment; and (3) being able to apply the treatment uniformly. Largely due to having acquired such knowledge, the cost of treatment (copper sulphate plus labor of application) in 1940 was only $658.45 as compared to $2,129.52 in 1939. Treatment should be given before the algae begin to multiply. As to quantity, large single doses are more effective than split ones. Danger of killing fish has been exaggerated—more fish are killed by the clogging of their gills with dead algae than by the copper sulphate itself.[A52]

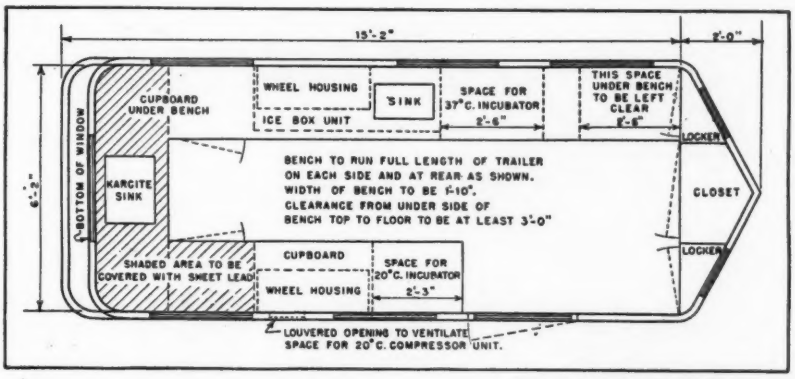
Designs for Mobile Laboratories

Several state health departments use mobile laboratories, most of which are built into bus type vehicles with their own motive power. A trailer laboratory with a tow car is used by the Oregon State Bd. of Health and by the Ohio River Pollution survey of the U. S. Public Health Service. The advantage is that the trailer can remain for several days at one place in constant use while the tow car collects samples. The P.H.S. laboratory provides for two laboratory operators and a sample collector. The trailer cost $1,850, tow car $649, laboratory equipment and miscellaneous, $1,116. It is connected to a water supply by garden hose and to a source of electrical energy by cable. The trailer is 17'2" by 6'2".[A44]

The Oregon trailer is 17'4" by 6'2", by 6' 2" high inside. It is designed for a continuous bacteriological analysis capacity of 70 water samples. Cost of trailer $935.55, plus $87 for plumbing and water supply and electrical installation and $327.85 for interior finish and equipment. Liquid wastes from the laboratory may be discharged to a sewer through a hose, or to two 20-gal. covered galvanized tubs.[A45]

Protective Lighting Of Water Works

In lighting waterworks properties to guard against possible sabotage it is advisable to plan for the worst possible visibility conditions, when sabotage is


15'-2"
2'-0"
CUPBOARD UNDER BENCH
WHEEL HOUSING
ICE BOX UNIT
SINK
SPACE FOR 37°C. INCUBATOR
2'-6"
THIS SPACE UNDER BENCH TO BE LEFT CLEAR
2'-6"
LOCKER
BOTTOM OF WINDOW
6'-2"
KARGITE SINK
BENCH TO RUN FULL LENGTH OF TRAILER ON EACH SIDE AND AT REAR AS SHOWN. WIDTH OF BENCH TO BE 1'-10". CLEARANCE FROM UNDER SIDE OF BENCH TOP TO FLOOR TO BE AT LEAST 3'-0"
CLOSET
LOCKER
SHADED AREA TO BE COVERED WITH SHEET LEAD
CUPBOARD
WHEEL HOUSING
SPACE FOR 20°C. INCUBATOR
2'-3"
LOUVERED OPENING TO VENTILATE SPACE FOR 20°C. COMPRESSOR UNIT.

Courtesy American Water Works Ass'n

Plan of mobile laboratory unit used on Ohio River Pollution Survey.

most likely to be attempted. If there is any glare from the lighting it should be in the eyes of the intruder and not in those of the guards. Care should be taken that, in lighting certain areas, others are not thrown into shadow. The boundary or other distant points should be more brightly illuminated than those nearer the guards. All backgrounds should be kept as light as possible, as by painting fences and buildings with light colors. Area lighting should be so planned that some light is contributed to every point from more than one source so that one lamp failure will not create any unduly dark area. Lighting along traffic routes should be so designed that the light will shine across the traffic lane and not blind the drivers. As much of the lighting equipment as possible should be kept well within the property where it can not be tampered with. Search lights can be used to sweep the area and explore the grounds outside, but are supplementary only.[A48]

Chemical Dry Feeder Specifications

Some items that should be included in dry feeder specifications, regardless of type, are: a hopper capacity of at least 8 hours' supply at normal rate or even maximum rate. A feeder range of about 40 to 1. A mixing chamber of such capacity that the material will be retained in it for at least 3 minutes at the maximum rate of feed when using water for a 10% solution. Adequate dust removal equipment. Bin gates between chemical feeders and large storage bins holding a car load or more. The manufacturer should know the kind of current available and the type of motor be specified.[Z3]

Lime Recovery From Softening Sludge

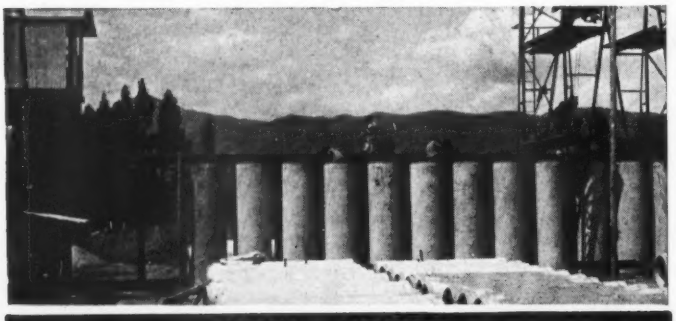
If calcium oxide can be reclaimed from the sludge of a water softening plant it will not only reduce the amount of commercial lime to be purchased but also eliminate the cost of disposal. Experience at Minneapolis indicate that a chemically satisfactory calcium oxide can be recovered from the sludge of a lime and soda ash softening process; when no coagulants are used in the precipitator a higher quality of lime will be obtained. The amount of lime recovered on a large-scale project should exceed the amounts used in the softening process. The economic feasibility of recovering lime is determined by three factors: the cost of new lime, the cost of calcination, and the cost of disposal of the sludge. High disposal cost may make calcination necessary.[A55]

Cutting Ice On Reservoirs

The Department of Public Health of Massachusetts permits cutting ice on bodies of water from which water is taken directly for domestic use, in cases where there has already been considerable investment for ice cutting equipment, under the conditions that no ice be harvested or workmen permitted nearer than 250 ft. from the waterworks intake; that no animals be driven upon the ice; that those employed use suitable receptacles for urine and excreta, which shall be removed from the watershed and disposed of under the supervision of the water works superintendent, and that expectorating or depositing other polluting materials on ice or water be prevented; that all ice harvesting be under the direction of the town water board; that all water withdrawn be adequately chlorinated during ice harvesting and for as long thereafter as the Department may determine, no harvesting to begin until chlorinating apparatus be operating satisfactorily; and that the Department be informed 24 hrs. in advance of cutting and immediately after it ceases.[B7]

Design of Dam Spillways

A suggested guide for maximum flood discharges to be provided for by spillways in Connecticut is as follows: For a watershed of 1 sq. mi., 800 c.f.s. per square mile; for 2 sq. mi., 700 c.f.s.; for 3 sq. mi., 600 c.f.s.; for 4 sq mi., 500 c.f.s.; for 5 sq. mi., 500 c.f.s.; for 10 sq. mi., 400 c.f.s.; for 25 sq. mi., 300 c.f.s.; for 50 sq. mi., 250 c.f.s. Many dam failures have been due to use of flash boards. Where collapsible flash boards are used, they may release such



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large amounts of water at times of flood as to greatly aggravate the flood conditions.[B8]

Materials for Pipe Jointing

Jute used in calking bell and spigot joints has been shown to contaminate water. Sulfur in compounds used in joints in Southern California has been attacked by certain organisms in the water, causing leaks. The Southern California Water Co. uses asbestos rope for packing where lead joints are necessary, but uses cement for jointing material in the great majority of cases, finding it cheap and easy to use, probably as permanent as the pipe itself, and capable of withstanding excessive shock; and absolutely eliminates leakage. The joints are made as follows, no packing being used: Portland cement, without sand, is mixed with just enough water to dampen it (½ gal. to 24 lb.) so that it will compact into a ball when squeezed, and will shatter when dropped one foot. The cement is mixed on a piece of canvas, and placed in the bell hole under the pipe joint. This mixture is tamped into the joint with a calking tool, then an ordinary calking hammer and cement calking tools are used to drive the material into place. We must emphasize that the calker must use hard blows. The joint must be dressed at least three times for 4-inch cast-iron pipe and four times for 6-inch cast-iron. The operation is repeated until the joint is calked solid. It will ring like a lead joint when properly done. The joint is finally pointed up with the fingers to a smooth surface. Twentyfour hours later the line will withstand full pressure. A 6" joint should not cost over 12 to 15 cts, including both labor and material.[A59]

Bacterial Infection Of Distribution Systems

A survey made by the Connecticut State Dept. of Health shows that bacterial infection of a distribution system may occur in a relatively short number of hours or even minutes, due to a temporary lapse in treatment, and may not be disclosed by routine samples. On the other hand, samples from distribution systems occasionally give puzzling and apparently alarming laboratory results when it is known that the treatment is adequate; one explanation of which may be that attenuated organisms under favorable water temperatures may start to multiply in the pipe system, that bacterial life present in a dormant condition on the sides of pipes may be released as a result of rising water temperature, and that in the absence of sufficient residual chlorine natural decomposition of dead organisms may cause increased bacterial growths in summer. For unfiltered surface supplies, superchlorination followed by de-chlorination may be the ultimate answer to unsatisfactory disinfection.

Filtration of all surface water supplies, even from clean watersheds, is being instituted increasingly to improve physical characteristics and incidentally will lessen the peaks of chlorine demand and add to chlorination efficiency.[B16]

Bibliography of Waterworks Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n,* note or short article; *p,* paper before a society (complete or abstract); *t,* technical article.

A *Journal American Water Works Ass'n.*
April

40. Water Works Schools. By H. B. Foote. Pp. 611-617.
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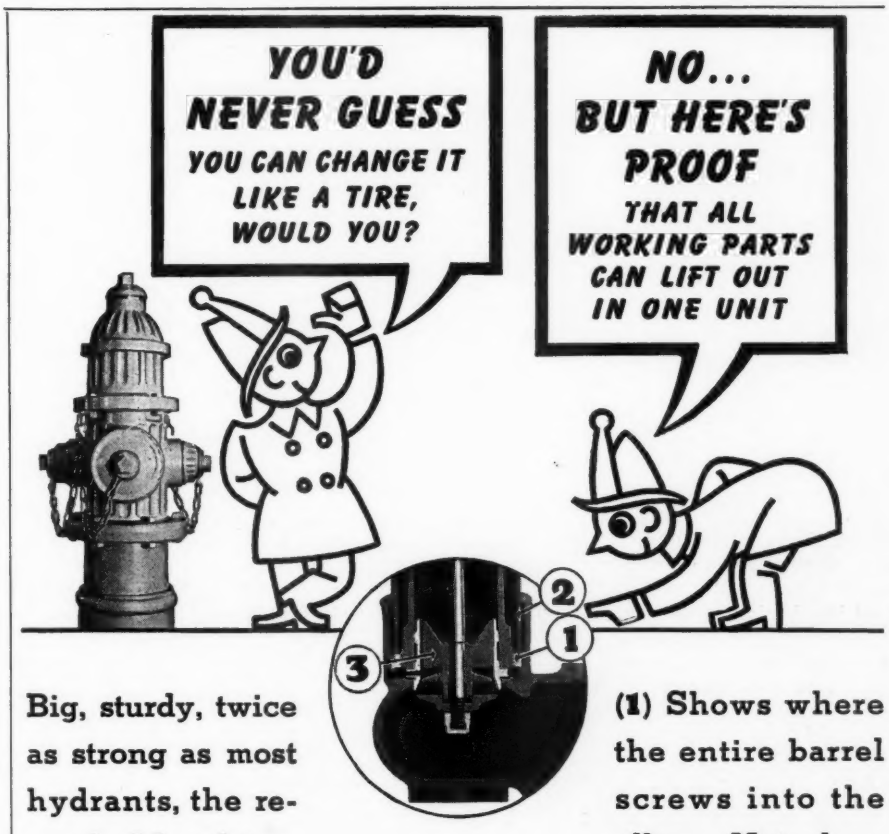
3. Dry Feed Chemical Equipment. By L. E. Harper. Pp. 19-24.
4. Bacteriological Quality of Water in Distribution Systems. By J. R. Baylis. Pp. 25-29.

Damages for Breach of Sewer Construction Contract

The New York Appellate Division, in Standard Improvement Corp. of Westchester County v. Village of Ardsley (19 N. Y. S. 3) affirmed judgment for plaintiff in an action by a contractor for damages for breech by the defendant municipality of a sewer construction contract, (1) by reason of the municipality's delay in procuring necessary rights of way and therefore in furnishing a clear site for the construction work; (2) by reason of the municipality's making changes in the line of the sewer and major alterations in the plan and scope of the work; and (3) by reason of the municipality's failure and refusal to allow, in the final estimate, and to pay for, certain items of work actually performed and materials actually furnished by plaintiff in the construction of the sewer system.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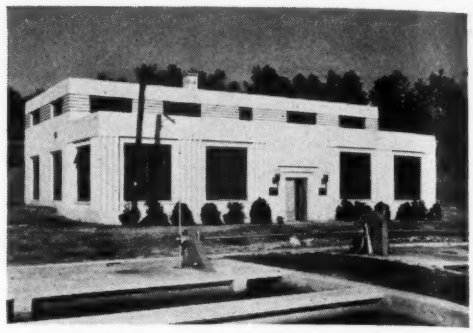


HOW TO FIND ORIGINAL ARTICLES. Key letter at end of each digest refers to name of publication listed in bibliography at end of this section. Numeral indicates title of article.

Treatment Developments of 1940

In a review of the literature published during 1940 pertaining to sewage and waste treatment, the committee says: "Industrial waste treatment . . . which pertains more to cleaner streams and better living conditions than to health hazards, indicates more clearly the general tendencies and future trend of thought of the whole problem. However, the health aspect of sewage treatment has been emphasized by the possibility that the dreaded infantile paralysis virus remains viable in, and is carried by, sewage, . . . The necessity for a thorough exposition of theory and practice of the activated sludge process is apparent to show where we stand in practice and research. By-product recovery from sewage and waste is becoming more and more of general interest."

In connection with collecting samples, "a consistently reliable solids balance awaits the development of practicable automatic samplers and improvement in sewage analyses to more adequately account for the coarser solids." "An important implication of the studies on pre-flocculation is that, in general, the first cost of tanks for self-flocculation and settling should be less than the cost of primary tanks alone for the same performance."[C27]

Relative Effectiveness Of Iron Salts as Coagulants

Some chemicals work better on a particular sewage than do others, due to variations in character of sewage such as age, strength, septicity, kind and amount of dissolved matter, and in some cases the presence of industrial wastes. No general laws can be set down as to comparative coagulating power of different chemical reagents but general facts, subject to variation under peculiar conditions, can be determined. Such general facts relative to iron salts, determined by studies of six different domestic sewages, are as follows: 1—Ferric chloride, 2—chlorinated copperas, and 3—ferric sulphate, is the general order of effectiveness in clarifying sewage, although the differences are not great. These salts are effective over the pH range of 2.0 to 10.0. The chloride ion is more effective for clarifying sewage in the acid pH range, which may account for the differences in effectiveness of ferric chloride and ferric sulfate. The action of lime in lowering the coagulant demand appears to be due to the action of the calcium ion on the dispersion medium and its own clarifying power in the presence of hydroxyl ions.[C28]

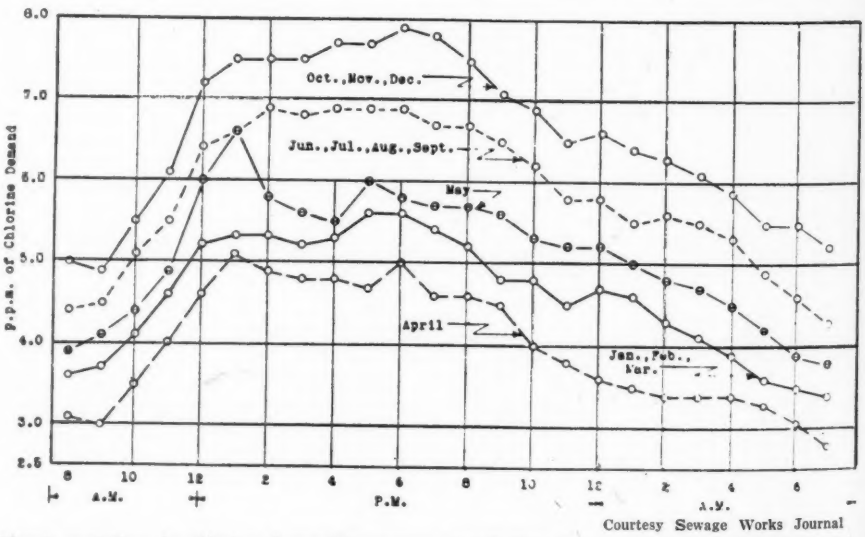
Variations in Chlorine Demand

Conclusions from data collected during 27 months of chlorination of Buffalo, N. Y., sewage include the following: The chlorine demand of sewage is dependent on local conditions of sewage strength and flow and chemical composition. The demand in ppm is not high if the sewage is low in sulphates, the rate of flow relatively constant, and the sewer run relatively short. Determination on composite samples of raw sewage or chlorinated effluents does not give the true demand when compared with the average of 24 hourly tests, being 12 to 25% low on raw sewage and 100 to 300% high for chlorinated effluents. The chlorine demand in ppm rises and falls with the temperature but lags behind it; the total in pounds per day also lags. Demand in ppm during an average day varies from 70 to 130% of the average but a single day's variation may be much greater; minimum demand occurs at 7 to 9 A. M., maximum at noon and after; rate in pounds per hour show a much wider variation. The demand due to industrial loads has peaks averaging approximately double the normal for that or the previous hour, which effects usually disappear within two hours. The per capita demand of Buffalo sewage is 0.01 lb. per day, excluding storm effects—slightly more than twice the value reported for strictly domestic sewage.[C29]

Natural Purification Of River Muds

Part of the pollutional load of a river settles to the bottom, where it undergoes benthal decomposition and interacts in various ways with the water above. About 30% of the organic matter in raw sewage may be so precipitated. The amount of work involved in stabilizing these muds may be a considerable proportion of all that the receiving water is called upon to do. Benthal decomposition fluctuates widely in character, quantity and rate; depth of deposit, or areal concentration of organic matter, may itself align it with processes akin to aerobic decomposition of flowing pollutional matters at one extreme or to anaerobic sludge digestion at the other, the former of which are associated with thin layers of sludge and the latter with thick, heavy sediment. The overall effect is a product of (1) rate of reaction, (2) amount of oxygen required for ultimate stabilization of a unit weight of decomposable matter, and (3) the weight of such matter present.

The quantity of oxygen required varies from almost the weight of the volatile solids present to a minimum of about 10% of this; and the demand the first day varies from approximately 20% of the



Courtesy Sewage Works Journal

Hourly variations in chlorine demand by seasons (excluding storms and industrial peak loads).

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ultimate demand to well below 1%. The rate of areal oxygen demand varies approximately as the square root of the areal concentration of volatile solids; although specific gravity of the solid matter, permeability and elastic properties of the deposit are important in determining the rate and eventual magnitude of benthal oxidation. Rates of decomposition decrease, as the deposit ages, in such manner that they are halved about every three months.[C31]

Flow in Effluent Troughs

Withdrawing the effluent from sedimentation tanks by means of a system of troughs has shown advantages over the older methods—the overflow velocities are reduced and approach currents are better directed to avoid disturbance of the settling solids. The troughs should be spaced evenly across the basin and not so close together that interference will result. A slight slope of the bottom—say 1 in. in 10 ft.—is desirable, but the crest of the trough should be as nearly level as possible. Rectangular troughs are recommended for simplicity and to save head. The capacity of a trough, determined from a large number of observations, is expressed by the formula

$$Q = Cby^{3/2}$$

in which C is a coefficient, with a value of about 2.32 for free overfall conditions; b is the width of the trough in feet; and y is the depth of water in feet at the closed (upper) end of the trough plus the difference in elevation between the ends of the bottom of the trough.[L2]

Service Charges For Refuse Disposal

With increasing demands for more adequate refuse collection and disposal, costs of the service are increasing. Service charge seems the logical way to raise the needed additional revenue, for it is an individual service, like sewage collection and disposal, and 85 cities on the west coast have adopted this method, but less than 6 east of the Rocky mountains. The cost of trucks is much less than that of a sewerage system, but the cost of collection and disposal is greater than that of sewage; the total annual costs including overhead are approximately equal. Refuse collection costs range from about $2.00 to $2.75 per ton for southern cities, from $3.25 to $5.75 for northern. Incineration costs range from 60 cts. to $2.42 per ton, averaging about $1.00. A general average cost of adequate service is from $4.50 to $5.00 a ton, or about $6 per service per year. The cost for individual services varies with amount of refuse and number of collections, and rates should be based on a minimum charge with additional charge for extra service. Charge schedules for a number of cities are given.[E9]

Sewage Pumped With Power from Incinerator

Providence,R. I., last year substituted use of power from an incinerator in place of steam in the pumping plant that raises the city's sewage to the treatment plant. The incinerator, built in 1936, has since that date furnished steam for steam turbines that operated air compressors of the activated sludge plant; but the pumps, three 45 mgd and one 70 mgd, were operated by steam. These were scrapped and replaced with four vertical pumps operated by synchronous motors, two of which are two-speed, two-capacity units, the others single speed and capacity. Of the former, one motor is of 150 and 300 hp, the other of 250 and 400 hp, having two windings for the two different speeds. The incinerator delivers current at 2300 volts, 3 phase.[J11]

Gas and Oil Engines for Plant

Greenville, S. C., last year placed in operation a 5 mgd treatment plant which included a $60,000 power plant containing two engines operated by sludge gas and a Diesel as a stand-by; although the gas engines can be changed to oil fuel by minor changes, or the Diesel converted to gas, either with no sacrifice of their h.p. rating. All three units are 4-cylinder developing 225 h.p. at 450 rpm. Digester gas is stored in a 40,000 cu. ft. tank;

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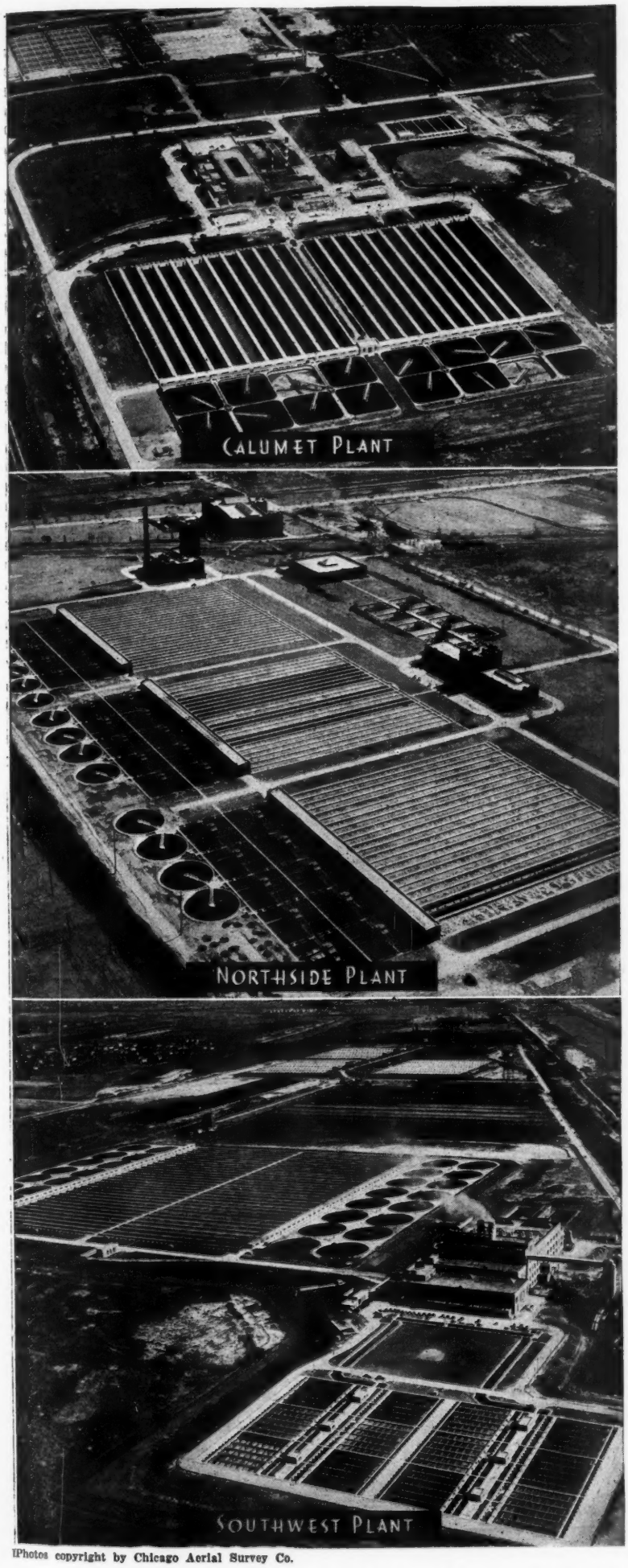

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70% of it is used by the engines, the remainder as fuel in a waste incinerator and to heat the buildings. Waste heat boilers and heat exchangers are used to obtain maximum heat return. Each engine is direct connected to a 150 kw G. E. generator. The cost of operating this power plant, including the salary of an additional operator but no allowance for depreciation, is $165 a month.[H22]

Controlling Odors Around Plants

To control odors, do the following: Clean screens and clean and wash down the screen chamber frequently. Dispose of screenings immediately. Collect and dispose of grease and scum. Remove sludge from primary and secondary tanks to the digester at frequent intervals. See that the digester is operated always on the alkaline side. Collect all digester gases and burn them. Regulate the withdrawal of digested sludge and plan the ultilization of the sludge beds so that it never becomes necessary to withdraw too much well digested sludge at one time. Keep the sludge bed surface level and porous. If these fail to prevent odors, use chlorine.[Z2]

Chemical Precipitation Of Sulfur Dye Wastes

It may be desirable to separate strong and highly colored wastes from wash waters and treat the former separately. Although the unit cost of treating strong discharges is very high, the total cost may be less than treating the large volume of composite waste at a low unit cost. The fill-and-draw method of operation appears to be more feasible than continuous operation when precipitating strong wastes, but the latter may be practicable when the waste is diluted with wash water. Acids and alum should not be used to precipitate sulfur wastes unless precautions are taken to control the hydrogen sulfide. Iron salts such as ferrisul, ferric chloride, and copperas can be used with this type of waste without the evolution of hydrogen sulfide. Flocculation is detrimental to the copperas floc and must be kept to a minimum. Lime aids in the production of floc with copperas. Dewatering is important because of the large sludge volumes; filtering the entire coagulated mixture appears satisfactory, especially since dewatering is rapid. The large chemical dosages required and the large volumes of sludge produced indicate that recovery of both the coagulant and the dye may be practicable, which has been confirmed by preliminary studies.[C32]

Sewage Pumping Installation Details

The New York State Dept. of Health requires, for new sewage pumping installations, that main pump stations must have at least three pumps, of such capacities that, with the largest out of service, the other two can pump the maximum flow; with power available from two sources where electric power is subject to interruption. Secondary lift stations should have duplicate equipment. Screening devices should, in general, be placed ahead of the pumps. Pumps should be located in a dry well.

Among many suggestions offered by the author a few are: Any screening device should be so located as to permit ready screening; where size of installation warrants the expense, mechanically raked screens with grinders, or a comminutor installation, is recommended. If grit chambers are not placed before the pumps, the wearing rings should be made of hardened steel, and water under pressure used in the stuffing boxes. The size of the wet well should be such as to permit pump operation without two frequent stopping and starting, but not so large as to act as a sedimentation basin. Long pump shafting is undesirable; it may sometimes be avoided by lowering the motor below ground floor level. Grease lubrication for shafting is preferable to oil. There is increasing tendency to use vertical-lift, horizontal pumps with some sort of vacuum priming, especially where the suction lifts do not exceed 15 ft.; the advantages being ability to place the pump and motor direct connected above high water, the reduction in space required at a lower level, and greater ease of maintenance.[C33]

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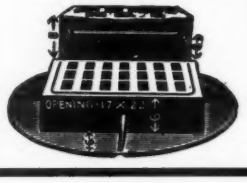

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Estimating Solids By Centrifuging

Suggestion that dry solids content of sludges could be stimated by centrifuging without evaporation, weighing, etc., led to a study of daily analyses over a 12-month period, from which it was concluded that: 1. There is a relation between the volatile matter content of sludge and the ratio of the volume of centrifuge solids to solids by weight. 2. The use of the test must be based on standardization for each sludge analyzed. 3. Final results of total solids by weight determined in this manner are only approximate. 4. The preliminary choice of a factor of 4 for digested sludge at Buffalo was approximately correct. 5. J. I. Smith's conclusions that "the centrifuge test is probably satisfactory enough for rough plant control work, but as a matter of record, should be supplemented by actual solids determinations," applies to raw and digested sludge as well as activated sludge.[G11]

Bibliography of Sewerage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

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27. Review of the Literature of 1940 on Sewage and Waste Treatment and Stream Pollution. By Committee on Research, Federation of Sewage Works Associations. Pp. 187-238.
28. *t.* Iron Salts and Lime in Coagulation of Sewage. By H. W. Gehm. Pp. 239-248.
29. Variations in the Chlorine Demand of Buffalo Sewage. By G. E. Symons, R. W. Simpson and S. R. Kin. Pp. 249-264.
30. Public Health Aspects of Sewage Treatment in Detroit. By W. M. Wallace and A. B. Morrill. Pp. 265-269.
31. *t.* The Natural Purification of River Muds and Pollutional Sediments. By G. M. Fair, E. W. Moore and H. A. Thomas, Jr. Pp. 270-307.
32. Chemical Precipitation of Sulfur Dye Wastes on a Pilot Plant Scale. By R. Porges, R. K. Horton and H. B. Gotaas. Pp. 308-317.
33. Sewage Pumping Installation and Maintenance. By N. L. Nussbaumer. Pp. 318-324.

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8. Sewage Treatment for Army Camps. Pp. 63-66.

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9. Service Charges for Refuse Disposal. By C. A. Smith. Pp. 48-51.

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10. A Digester Corrosion Problem. By G. A. Parkes. Pp. 99-105.
11. Estimation of Total Solids in Sludges by Centrifuging. By G. E. Symons and W. L. Torrey. Pp. 106-108.
12. Combination Plant Treats Sewage and Tannery Wastes at Middleborough, Ky. By J. S. Parker and J. S. Watkins. Pp. 109-114.
13. Cleveland Sewage Treatment Situation. By J. W. Ellms. Pp. 116-118.

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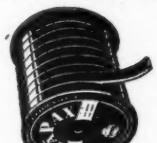

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Keeping Up With New Equipment

Littleford Roller

Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio

Littleford Bros. have developed a new *Motorized Portable* Patch Roller, the *Trail-O-Roller* Model No. 155.

This new Model 155 Trail-O-Roller is designed to have the operator seated while the roller is in operation. All controls are at the operator's finger tips.

Features of the Trail-O-Roller are: (1) The ease of converting from trailing to rolling position; an unique hydraulic arrangement raises and lowers the Roller with ease, no back breaking jacking up or lifting. (2) Heavy duty clutch especially designed to stand hard usage. (3) Automobile type steering control for easy control of front roller. (4) split front 18" dia. front roller for easier steering. (5) Removable wheels and stub axles for rolling up to poles, walls, or curbs.

The Littleford Model No. 155 Trail-O-Roller will trail behind any truck at any speed, to change to the rolling position requires about two minutes time. Trail-O-Roller is designed for rolling patches, shoulder widening, clay subbases, parking areas, airport runways, alley paving, etc.

For literature on the New Littleford Model 155 Trail-O-Roller, write Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio.

Littleford Trail-o-Roller.

Sewage Used for Washing Walls in Disposal Plants

Marlow Pumps, Inc., Ridgewood, N. J.

The illustration shows an operator of a disposal plant washing down the side walls using sewage flowing through the plant for this purpose. The sewage is also used to break up the scum in the gas vats. The pressure is sufficient to remove the algae which

Washing sidewalls with sewage.

forms on the walls of the tanks and in warm weather it has been found necessary to do this washing at least once a day to avoid odor.

The plan obviates the necessity of purchasing water which adds to the sewage load.

A 3" Marlow centrifugal self-primer driven by a 5 h.p. Briggs & Stratton air-cooled engine has been in use at the sewage disposal plant at Lawrence, Long Island, N. Y. for approximately 6 years. It is claimed that the savings over a period of nine months will pay the cost of the pumping outfit.

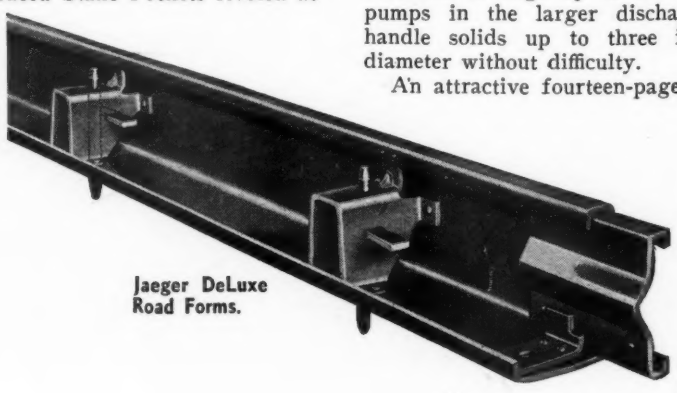
New Heavy Gauge Road Form

Jaeger Machine Co. Columbus, Ohio

Increased rigidity and greater accuracy of alignment are the big advantages claimed for Jaeger DeLuxe Road Forms. Made of special carbon steel plate 7/32" thick, in place of the usual 3/16", and with improved design Triple Braced Stake Pockets riveted at 5 points to base-face-top of form, these heavy duty Road Forms are built to hold true to line and grade and resist distortion under modern heavy duty, high speed spreading and finishing equipment.

Although far huskier and stronger throughout, with an estimated 50% longer life, a 9" x 8" section weighs but 21 lbs. more than ordinary 3/16" forms. Other advanced features include: Joint Plate, completely telescoped with both Top Rail and Base Guide insures perfect alignment, maximum rigidity of lock, and provides support for outside edge of Top Rail. Lock Plate extends 3" from face of form for easier hammering when locking or unlocking; eliminates 90% of breakage. Chamfered ends facilitate setting of curves. Jaeger "Duorails," for centering load when needed, fit this standard form.

These extra gauge forms will withstand greater use and abuse, last longer, and are designed to reduce high spots and save costly hand work.



Jaeger DeLuxe Road Forms.

New Sump and Bilge Pumps

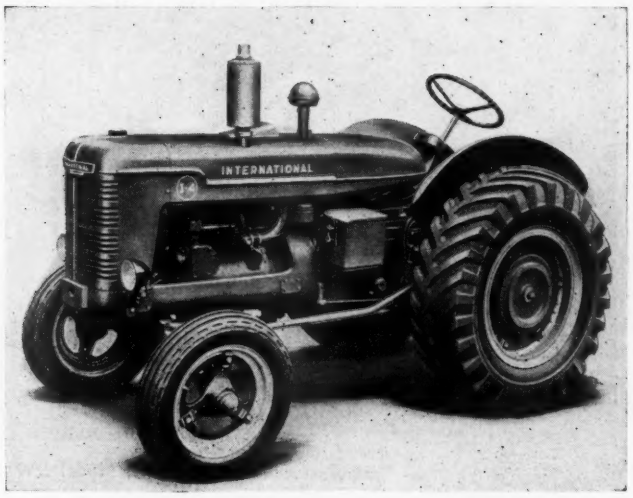
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

Fairbanks, Morse & Co. announces a new line of "non-clogging" centrifugal pumps specifically designed for intermittent-duty sump or bilge pumping, wet-pit, or submerged service. Known as Fairbanks-Morse 5410SS submerged suspended sump and bilge pumps, the products are a modern modification of the famous A.B. Wood design.

Designed for such municipal installations as disposal of surface or storm water or drainage of deep basements or underpasses, they are available in 2, 3, 4, and 5-inch sizes for capacities up to 1400 g.p.m. for heads up to 120 feet and settings up to 25 feet. The pumps in the larger discharge sizes handle solids up to three inches in diameter without difficulty.

An attractive fourteen-page bulletin,

"International" Model ID-9 Industrial Wheel Tractor.



"International" Model I-4, Diesel Wheel Tractor.

describing the complete line of 5410SS sump and bilge pumps, has just been released by Fairbanks, Morse & Co.

Five New Industrial Wheel Tractors

International Harvester Co.,
180 N. Michigan Ave., Chicago

International Harvester's latest additions to its line of equipment are five new wheel tractors. The tractors are designed as the "I" line and include three models with carburetor-type engines and two with International's quick, easy starting, full-Diesel engines.

These new "I" models are especially adapted for a variety of construction, maintenance, materials-handling, and transportation work for contractors; county, municipality, and other government departments; airports.

All five new tractors have Tocco-hardened crankshafts, pressure lubrication, replaceable cylinders, five forward speeds up to 15 miles per hour (except the I-6 and ID-6 which have five speeds up to 14 miles per hour), gear drive, countershaft brakes that can be individually controlled or interlocked, provision for mounting a variety of allied equipment, and various other features.

The three tractors with the carburetor-type engines are respectively designated as Models I-4, I-6, and I-9. The engines are of the four-cylinder, valve-in-head type. The engine of the I-4 develops 29.5 horsepower at rated governed speed of 1,650 r.p.m.; that of the I-6, 40.5 horsepower at rated governed speed of 1,450 r.p.m.; and that of the I-9, 54 horsepower at rated governed speed of 1,500 r.p.m. The bore and stroke of the I-4 are 3⅜ by 4¼ inches; of the I-6, 3⅞ by 5¼ inches; of the I-9, 4.4 by 5.5 inches.

The two new Diesel-powered tractors are respectively designated as the ID-6 and ID-9 and in dimensions and other characteristics, excepting engines, are similar to the I-6 and I-9. The Diesel engine of each tractor not only uses low-priced fuel but also uses much less fuel than a conventional engine of the same size. And, like all International Diesels, it starts as a gasoline engine and is quickly converted to full Diesel operation by means of a lever within easy reach of the driver.

The engine of the Diesel ID-6 develops 38.5 horsepower at rated governed speed of 1,450 r.p.m., and that of the Diesel ID-9 develops 51.5 horsepower at rated governed speed of 1,500 r.p.m. Th bore and stroke of the ID-6 are 3⅞ by 5¼ and of the ID-9, 4.4 by 5.5 inches.

The Fisher M-Scope Pipe Finder

Fisher Research Laboratory
1961 University Ave., Palo Alto., Calif.

The new instrument is an improvement over the older type M-Scope providing three modes of operation: 1, Inductive; 2, Conductive; 3, Radio Balance.

The Inductive is for quick tracing of pipes, cables, and service connections, etc., without making it necessary to actually contact the pipe or cable. With one setup as much as one thousand feet can be covered.

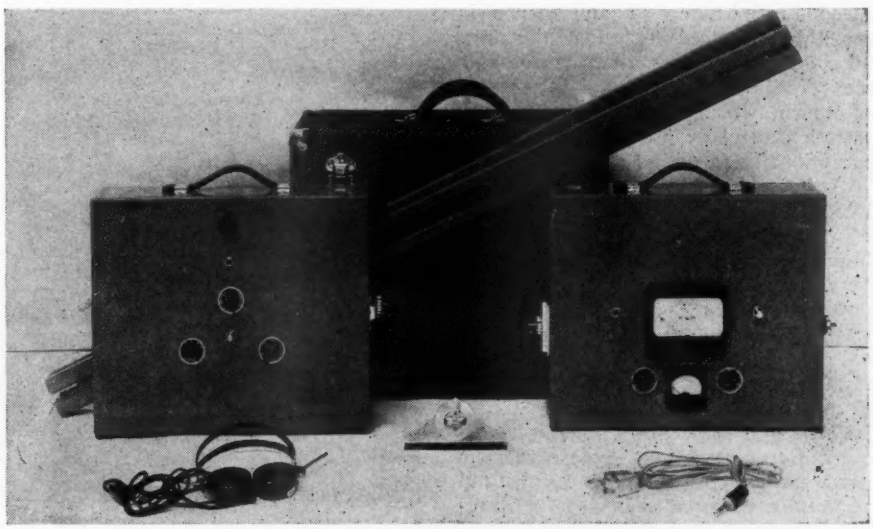
The Conductive operation is adapted in cases where there is a complexity of pipes and cables. One conductor can be located among a mass of others by using the conductive method. It is only necessary in this case to contact the cable or pipe at one point. There is no need for grounding and spreading out of wires over pavement.

The Radio Balance operation permits the locating of manhole covers, meter boxes, Dresser couplings. The instrument can be carried assembled in front of a ditch digger to locate metal obstructions in its path.

Non-conductive pipe can be traced by pushing a steel tape through a non-conductive pipe. If this is done, such a pipe can be just as easily located as a metal pipe.

The power output of the new 3-in-1 unit is double that of the older model and can be regulated in 5 steps. The controls are properly marked.

The new 3-in-1 unit has, besides a pair of headphones, a large 4½ inch visual indicator for exact centering and depth locating. An additional 2 inch



Fisher M-Scope Pipe Finder—3 Pipe Finders in 1.

Caterpillar Industrial Tractor, Model DW-10.

visual indicator is provided for quick tracing through heavy traffic.

The instrument is delivered in a substantial leatherette carrying case with compartments for accessories.

For more complete description write the manufacturer.

½-Yard Excavator

Bucyrus-Erie Co., South Milwaukee, Wis.

Following a long-established policy of designing and building excavators specifically for the capacity desired rather than "stretching" existing models to new specifications, Bucyrus-Erie announces the development of a wholly new ½-yard machine—the 15-B. Simplified front-end construction makes the new unit easily convertible in the field from shovel to dragline, crane or drag shovel. Standard power is a 54 h.p. gasoline engine with specially-designed carburetor and manifold to provide peak efficiency under rapid load fluctuations; both Diesel and electric power, similarly "tailored" to the requirements of excavator service, are also available.

Designed along the same principles which made the ⅜-yard Bucyrus-Erie 10-B, the new 15-B features high output at low operating and maintenance costs. The proportion of power and speed in hoist, crowd and swing is smoothly balanced for fast digging. Direct-action clutches give the operator the "feel" of the load and a sureness of touch which gives him accurate, smooth control over every phase of an exceptionally fast digging cycle.

A boom hoist lever is conveniently located in the main lever bank in front of the operator, giving independent high speed power-controlled raising or lowering. This lever can be set in the down position and the operator's hand removed for use in swinging, hoisting or propelling. The boom lowers at a regular rate until the lever is returned to neutral. In crane service—particularly in steel setting and other work requiring accurate control—the new boom hoist speeds up operations safely and accurately. All-welded booms for dragline, clamshell and crane service have been designed to give the 15-B maximum range and capacity per pound of weight. Field convertibility has been simplified by mounting crowd rope and drum on the shovel boom. No clutch or brake changes are required for conversion from dragline or crane to shovel—only the crowd-chain unit need be added. Levers and direction of lever throw may be changed if desired.

Full details of the new ½ yard 15-B may be obtained by writing to this magazine or to Bucyrus-Erie Company, South Milwaukee, Wisconsin.

New Rubber-Tired Tractor

Caterpillar Tractor Co., Peoria, Ill.

A rubber-tired industrial tractor, powered by a 90-horse-power Diesel engine and capable of hauling more than 13 tons of earth at 18 miles an hour, has been announced by Caterpillar Tractor Co. of Peoria, Illinois. "Caterpillar" has also designed and built an 11 cubic yard heaped measure, bottom dump, pneumatic tired wagon to go with the new tractor. Hydraulic scrapers, especially designed for the machine are manufactured by the LaPlant-Choate Mfg. Co., Inc., of Cedar Rapids, Iowa; and cable controlled scrapers, by R. G. LeTourneau, Inc., of Peoria.

The DW-10 tractor has been introduced after more than three years of intensive development work and field tests. It is built specifically for use on roadbuilding, construction and national defense projects, where speed, long hauls and other physical conditions are favorable to rubber tires.

Powered by the D468 "Caterpillar" Diesel six-cylinder, water cooled automotive engine, the tractor weighs 14,500 pounds, and has a tractive effort of 13,000 pounds in low gear, with a loaded wagon or scraper. A quick acting, vertical type of governor gives fast pickup to get the loaded tractor and wagon to full speed almost immediately. The transmission is the constant mesh type, and has five forward speeds, ranging from 2.4 to 18 MPH; and one reverse speed of 3 MPH.

The DW-10 tractor has a "high traction" differential, which gives increased pulling ability under unfavorable ground conditions, plus longer tire and engine life. Engineered for heavy duty hauling service, the differential applies greatly increased torque to either driving wheel, should the opposite wheel start slipping. In addition to increased pulling power, this increase in torque lessens tire slippage, as well as keeping a more even load on the engine. The actual transfer of torque from one wheel to the other reaches a ratio as high as 1.7 to 1 with this differential.

Bucyrus-Erie ½-Yd. Excavator.

Chem-O-Cabinet.

Chem-O-Cabinet Feeds Nearly All Chemicals

Proportioneers, Inc., 9 Codding St., Providence, R. I.

The manufacturers say that the Chem-O-Cabinet feeds and accurately proportions Hypochlorite, Dilute Ammonia, Soda Ash, Ferric Chloride, Ferric Sulphate, Caustic, Milk of Lime, Copper Sulphate, Sodium Silicate, and Calgon.

The cabinet is equipped with a 85 lb. per square inch pressure proportioning pump and all accessories including parts to easily interchange for feeding various chemicals, folding Neoprene bag for Hypochlorite, orthotolidine test kit and spare parts for a year's service. It is a single unit for permanent installation or for portable emergency service.

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Hardinge Hydro Classifier

Hardinge Co., York, Pa.

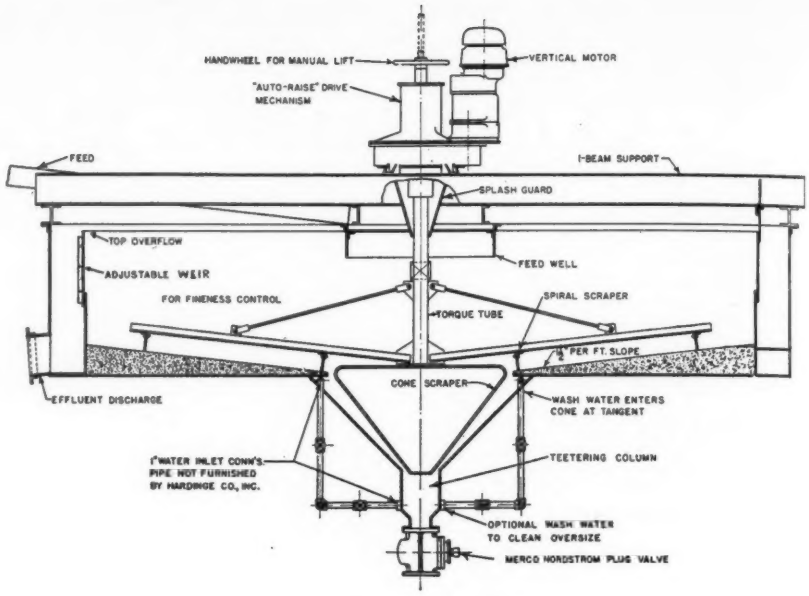
The diagrammatic sketch shows the Hardinge Hydro Classifier in which some noteworthy improvements have recently been made. Several installations of this machine have been made during the past year for classifying operations, particularly in sand washing plants for washing sand free of included clay and micron sizes of sand.

The Hydro Classifier consists of a circular steel tank divided into two compartments, a main or upper one equipped with an adjustable overflow weir in which agitating and collecting spiral rakes operate, and a conical shaped lower one where a final wash is given the product being made.

The simple means now used permits making various sizes of products on one machine by varying the volume available for retention and at the same time the settling out period in it. This is accomplished by using a telescopic type peripheral weir, which permits varying the classifier depth from a maximum operating depth to one-half of its maximum, or at any in-between point. A sand product may be made varying anywhere from practically all plus 80 mesh to practically all plus 240 mesh by this arrangement. Extremely fine material is removed as an overflow product.

Another interesting feature of the Hydro Classifier is the sand cleaning chamber below the raking section where water enters tangentially, gives a swirling action to the sand and removes the last traces of included fines or silt.

The machine is operated by a motor through an enclosed oil lubricated drive gear and includes the Hardinge "Auto-Raise" feature to prevent damage from sudden overloads. Power requirements are small, a 1½ H.P. motor being sufficient to operate a 20-ft. dia. classifier.



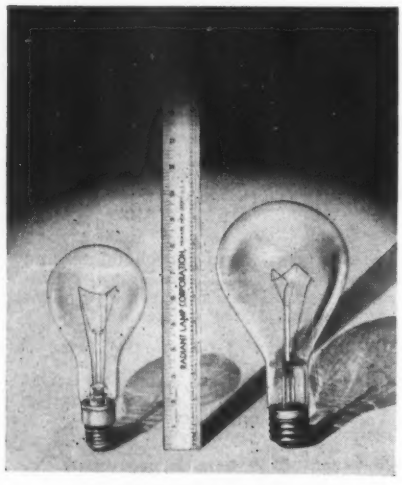
Hardinge Hydro Classifier.

High-Wattage Lamp

Radiant Lamp Corp., 341 Sherman Ave., Newark, N. J.

The manufacturers claim it will enable states and municipalities to increase road and street illumination up to 250% or more without changing fixtures. The use of a hard glass bulb has made it possible to reduce the size of a 500 watt lamp to that of an ordinary 200 watt lamp, and causes it to withstand thermal shocks.

Former attempts to reduce the size of high wattage lamps resulted in melting of the bulb or collapse of the filament support, due to the intense heat developed. In place of the large "mogul screw" base and heavy fixture necessary to support the weight of an ordinary 500 watt lamp, the new lamp made by the Radiant Lamp Corp., 341 Sherman Ave., Newark, N. J., can use a "medium screw" base like those in ordinary household fixtures. Unlike conventional lamps, the hard glass Radiant Lamp is said to withstand the sudden shocks of rain or sleet without cracking.



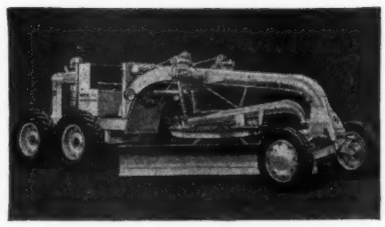
Radiant High Voltage Lamp.

Allis-Chalmers Model "AD" Motor Grader

Allis-Chalmers Manufacturing Company announces the new Model "AD" Motor Grader which weighs 21,500 lbs. and has 75 Diesel horsepower. This machine has been designed for heavy grading, bank cutting, ditching (both forward and reverse), oil mixing and snow removal.

Greater earth-moving capacity is attained through more clearance under the front axle and circle permitting the full volume of dirt to roll off the blade without hanging up in the axle or circle thus absorbing engine horsepower, decreasing travel speeds and increasing fuel consumption. The exclusive "Hi-arch" front axle has 22 inches of clearance and there is 6¾ inches of clearance between the "Roll-away" blade and the circle.

Power is supplied by the smooth General Motors 2-cycle Diesel engine developing 75 brake horsepower. This 2-cycle engine has a power stroke on every down stroke of the piston, therefore, standard equipment includes electric starting and lighting, leaning wheel front axle, adjustable radiator shutters, muffler, 12-foot moldboard, two 7.50-24 (10 ply) front tires and four 12.75-24 (8 ply) rear tires. For special conditions 10 and 14-foot moldboards, 2-foot extensions, 11 tooth scarifiers, all steel canpy top or all steel cab and a V-type snow plow are available.



Allis-Chalmers Grader.

Anhydrous Ammonia

A new booklet entitled "Mathieson Anhydrous Ammonia" has recently been announced by The Mathieson Alkali Works, 60 East 42nd Street, New York, N. Y. The book is sixteen pages and cover and measures 6″ x 9″.

Some of the subjects covered in detail are the chemical and physical properties of liquid anhydrous ammonia, including curves on pressure and temperature relations, density of liquid ammonia and solubility of ammonia in water; ammonia containers and their safe handling; withdrawing ammonia from containers and from the system; piping and valves; ammonia leaks; physiological effects of ammonia; and first aid measures in case of serious injury or exposure.

Copies of this new Mathieson booklet are available to consumers upon request.

PEOPLE . . . *Here and There*

Water Works Manufacturers' Ass'n Appoints Secty.-Mgr.

Arthur T. Clark, Morristown, N. J., has been appointed Secretary-Manager of the Water and Sewage Works Manufacturers Association, comprising 150 leading manufacturers supplying equipment and materials in the fields of water supply and sewage disposal.

Mr. Clark is a Civil Engineer of broad experience in operation, construction and design of plants, as well as in the manufacturing and sales end of the field. He is widely known.

After graduating from Rensselaer Polytechnic Institute with the degree of C. E. in 1907, Mr. Clark became Assistant Engineer with Robert E. Horton, Consulting Hydraulic Engineer, Albany; then Superintendent of the Municipal Commission of Herkimer, N. Y., in charge of Water, Sewer, Electric, Police and Fire Departments, and subsequently Manager of the South Bay Consolidated Water Co., Long Island, N. Y., and Chief Engineer of the Community Water Service Co., New York.

Following several years in both consulting and municipal engineering work at Morristown, N. J., Mr. Clark became affiliated with the sales engineering staffs of several leading manufacturers, including the Barrett Company, Joseph G. Pollard Co., and Pomona Pump Co.

Headquarters offices for the Manufacturers Association are being established in New York and Mr. Clark will assume his new duties about May 1.

Founded in 1908 as the Water Works Manufacturers Association and for the past 33 years having full charge of all manufacturers' participation in the American Water Works Association and other water works conventions, it was only in the past years that the activities of the association were expanded to include the rapidly developing sewage disposal field. The new constitution and by-laws adopted last July provided for the appointment of a Secretary-Manager by the Board of Governors, and Mr. Clark will be the first to fill this office.

George H. Dent With Asphalt Institute

W R. Macatee, Managing Director of The Asphalt Institute, has appointed, effective May 1st, George H. Dent District Engineer with office in the Transportation Building, Washington, D. C.

An alumnus of the University of Maryland, Mr. Dent served with the State Roads Commission of that state from 1924 to 1940—as Materials Engineer from 1936 to 1938 and as Soils and Bituminous Engineer from 1938 to 1940—receiving the appointment, as of January 1, 1941, of Paving Engineer for the Civil Aeronautics Administration for the 13 states comprising the North Atlantic Division, with headquarters at LaGuardia Field, New York.

Mr. Dent's appointment, therefore, brings to Washington, to supplement the activities of Mr. Macatee, another competent and qualified representative of the asphalt industry to assist wherever practicable in the Government's vast road-building and airport construction programs.

Harry Strube Now Link-Belt Eastern Division Chief Engr.

Link-Belt Company announces that Mr. Harry L. Strube has been appointed chief engineer of the Link-Belt eastern division, with headquarters at the company's Philadelphia plant, to succeed Mr. F. F. (Ferd) Waechter, who has resigned after rounding out 43 years of service.

Mr. Strube has been assistant chief engineer at Philadelphia, having begun his Link-Belt service in the engineering department of the company's Pershing Road Chicago plant in 1910. Subsequently he served as sales engineer, first at Chicago and then in Philadelphia. In 1924, he rose to the position of manager of vibrating screen sales, and in 1934, was made assistant chief engineer.

Expansion Joint Company Formed

Recent newcomer to the expansion joint field is the Keystone Asphalt Products Company, 43 East Ohio St., Chicago, a division of the American-Marietta Company.

Grover M. Hermann, who heads both companies, says the Keystone Division will operate nationally, producing a complete line of asphalt expansion joints, many resilient types such as fiber, cork, etc. Other products are Sewer Compounds, Sub-Grade Felts, Asphalt Planking.

T. R. Johnson, who has long been identified with the paving industry and for the past ten years has specialized in the expansion joint field, has been appointed sales manager of the new division.

Link-Belt Promotes Ralph Hoffman

The Board of directors has elected Ralph M. Hoffman a vice-president, delegating to him the general direction and supervision of sales for Link-Belt Co., Chicago, Ill.

Exhibitors at the American Water Works Convention 1941

Activated Alum Corp.
American Cast Iron Pipe Co.
American City Magazine.
American Rolling Mill Co.
Atlas Mineral Products Co.
Badger Meter Mfg. Co.
Barrett Co.
Bingham & Taylor Corp.
Birch Mfg. Co.
Buffalo Meter Co.
Builders Iron Foundry.
Calgon, Inc.
Carson Cadillac Corp.
Central Foundry Co.
Centriline Corp.
Chapman Valve Mfg. Co.
Chicago Bridge & Iron Co.
Clayton Mfg. Co.
Cliffs Dow Chemical Co.
Crane Co.
Darco Corp.
DeLaval Steam Turbine Co.
Dorr Co., Inc.
Dresser Mfg. Co.
Electro-Rust Proofing Co.
Engineering News-Record.
Ford Meter Box Co.
General Paint Corp.
Michael Hayman & Co.
Hays Mfg. Co.
Hersey Mfg. Co.
Homelite Corp.
Hydraulic Development Corp.
Industrial Chemical Sales.
International Filter Co.
Johns-Manville.
Layne-Bowler Co.
Lead Industries Asso.
Lock Joint Pipe Co.
Ludlow Valve Mfg. Co.
McWane Cast Iron Pipe Co.
Monsanto Chemical Co.
Mueller Co.
National Iron Corp., Ltd.
National Meter Co.
National Tube Co.
National Water Main Cleaning Co.
Neptune Meter Co.
Permutit Co.
Pitometer Co.
Pittsburgh-Des Moines Steel Co.
Pittsburgh Equitable Meter Co.
%Proportioneers, Inc.%
Public Works Journal Corp.
Rensselaer Valve Co.
Salomon, L. A. & Bro.
Simplex Valve & Meter Co.
Smith, A. P. Mfg. Co.
Sparling, R. W.
Thomson Meter Corp.
U. S. Pipe & Foundry Co.
Victaulic Co. of Canada, Ltd.
Vogt Mfg. Co.
Wailes Dove-Hermiston Corp.
Wallace & Tiernan Co., Inc.
Waterous Co.
Water Works Engineering.
Water Works & Sewerage.
Wood, R. D. Co.
Worthington-Gamon Meter Co.

Rawn and Boyce Now Quartermaster Consultants

A. M. Rawn, Chief Engr. & Gen. Mgr., Los Angeles County Sanitation Districts, and Earnest Boyce, State Sanitary Engineer of Kansas have been engaged by the Quartermaster General as consultants, replacing Samuel A. Greeley and E. B. Black. Charles R. Velzy, Works Supt., Buffalo Sewer Authority, has been appointed as assistant to Rawn.

M. P. Robinson Joins Worthington

M. P. Robinson, proprietor of the Robinson Filter Company has joined the Worthington Pump and Machinery Corp. to take charge of that firm's newly organized water purification equipment division. Before establishing his own water purification company in 1937 Robinson had, for seventeen years, been eastern representative of the International Filter Company of Chicago.

Hydrology Conference, State Col., Penn., June 30 to July 2

A conference on hydrology is to be held at State College, Pennsylvania, from June 30 to July 2, 1941, under the joint sponsorship of the Section of Hydrology of the American Geophysical Union, the Civil Engineering Division of S.P.E.E., the Committee on Hydrology of the American Society of Civil Engineers, and The Pennsylvania State College.

The conference program is subdivided into five symposia under the headings: The scope of applied hydrology, Rainfall and runoff, Delays in the hydrologic cycle, Losses in the hydrologic cycle, and Flood problems. The last half day of the conference will be devoted to round-table discussions of hydrology and its engineering applications. Program arrangements are under the direction of F. T. Mavis, Head, Department of Civil Engineering, The Pennsylvania State College, and a national advisory committee of which L. G. Straub, Director of the St. Anthony Falls Hydraulic Laboratory of the University of Minnesota, is chairman.

Inquiries regarding the conference may be addressed to F. T. Mavis.

James Anderson Co. Engineer for North Shore San. Dist.

The James Anderson Company, Lake Forest civil engineering firm, has been named engineer for the North Shore Sanitary District.

Boston Selected for NEWWA Convention

The sixtieth annual convention of this association will be held at the Hotel Statler, Boston, September 23rd to 26th inclusive.

NEW OFFICIALS

Newly appointed City Engineers are:

C. B. Tucker, Temple, Ariz.
Ralph Congreve, El Centro, Calif.
Joseph M. Peirce, Fitchburg, Mass.
Hal Parker, Clinton, Mo.
D. F. Talbott, Fairmont, W. Va.

Water Works Superintendents recently reported include:

Geo. R. Wade, Long Beach, Calif.
Jack Burton, Marietta, Ga.
Fred Lamb, Newnan, Ga.
Bruce Hamler, Rome, Ga.
L. B. Hellmeyer, Centralia, Ill.
R. E. Graham, Galesburg, Ill.
Walter Throckmorton, Storm Lake, Ia.
W. J. Lang, Waterloo, Ia.
Herman Hussel, Henderson, Ky.
H. E. Smith, Adrian, Mich.
L. B. Harrison, Bay City, Mich.
James Corn, Cameron, Mo.
Carl Eggert, Kirksville, Mo.
Wm. Yost, Sr., Madison, N. J.
W. M. Lybrook, Greensboro, N. C.
Wm. Schlecht, Velva, N. D.
E. H. Herbert, Norfolk, Va.
J. Frank Henderson, Waynesboro, Va.
Oscar Bedker, Beaver Dam, Wis.
Harold Londo, Green Bay, Wis.

County Engineers recently appointed are:

Woolsey Finnell, Tuscaloosa Co., Tuscaloosa, Ala.
Jas. G. Mosely, Cleveland Co., Rison, Ark.
Kern McClendon, Desha Co., McGehee, Ark.
Virgil Brookhart, White Co., Searcy, Ark.
A. Y. Preble, Imperial Co., El Centro, Calif.
O. F. Cooley, Los Angeles Co., Los Angeles, Calif.
Willis W. Reinke, Spencer Co., Rockport, Ind.
Edward F. Baker, Union Co., Creston, Ia.
W. J. McCosh, Fremont Co., Sidney, Ia.
E. L. Higgins, Reno Co., Hutchinson, Kan.
C. E. Ellerbrook, Wyandotte Co., Kansas City, Kan.
Clarence Cunningham. Rush Co., La-Crosse, Kan.
F. A. Rody, Pratt Co., Pratt, Kan.
Dale Williams, Logan Co., Russell Springs, Kan.
Robert L. Edwards, Adair Co., Columbia, Ky.
P. J. Letz, Arcadia Parish, Crowley, Ia.
John R. MacQueen, Cook Co., Grand Marais, Minn.
E. S. Duncan, Clinton Co., Plattsburg, Mo.
A. M. Foreman, Keya Paha Co., Springview, Nebr.
Harry Dusz, Athens Co., Athens, Ohio.
Martin Berry, Wood Co., Bowling Green, Ohio.
Houston Coates, Hamilton Co., Cincinnati, Ohio.
Wm. B. Slagle, Union Co., Ind., College Corner, Ohio.
D. E. Patterson, Lorain Co., Elyria, Ohio.
C. H. Bricker, Medina Co., Medina, Ohio.
Edward C. Hess, Monroe Co., Stroudsburg, Pa.
Ben Schmidt, Spink Co., Redfield, S.D.
J. K. Black, Clay County, Vermillion, S. D.
H. R. Gibson, Jefferson Co., Dandridge, Tenn.
Jas. D. Curnette, Nueces County, Corpus Christi, Tex.
John M. Peel, Antacosta Co., Jourdanton, Tex.
A. J. Roach, Gaines Co., Seminole, Tex.
D. B. LaPrade, Montgomery Co., Christiansburg, Va.
Nelson M. Collier, Walla Walla Co., Walla Walla, Wash.
Roy Nunn, Douglas County, Waterville, Wash.
Don West, Chelan Co., Wenatchee, Wash.
N. P. Hayes, Brown Co., Green Bay, Wis.
Harry Holswade, Roane County, Spencer, W. Va.
C. R. Hughes, Florence County, Florence, Wis.
Lyle Fuller, Marathan Co., Wausau, Wis.
Harry Young, Converse County, Glenrock, Wyo.

NEW CATALOGS RECEIVED

Modernizing Diesel Engines

The FM Diesel Engines are so designed that those which have been in service for many years can now be modernized by the use of certain change-over parts. Hundreds of them are being rebuilt with new parts—cylinder heads, cylinders, pistons, connecting rods, needle bearing piston pins, etc. The result is greater power, increased economy, and over-all efficiency throughout.

The result is that the owner of a Fairbanks Morse Diesel need not worry about obsolescence. They can be easily brought up-to-date on their original basis at a nominal cost.

Write for "Modernizing Your Diesel" a booklet issued by Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

Government Earthmovers

"Making America Strong" is the theme of a new 8-page governmental folder recently released by R. G. LeTourneau, Inc., of Peoria, Illinois, world's largest manufacturer of tractor-drawn earthmoving equipment. This folder graphically illustrates and describes construction progress on Airport, Roadway, Water Power, Irrigation and Housing Projects.

Job photos and facts show how equipment development makes possible the high-speed progress required of America's defense program. This appropriate red, white and blue folder has been prepared for city, township, county, state and federal officials, as well as contractors interested in governmental contracts. Emphasis has been placed upon county road development.

You may secure this folder by writing R. G. LeTourneau, Inc., Peoria, Ill. Ask for Folder A-13.

Digester Gas Flame Traps and Pressure Relief Valves

How P.F.T. Flame Traps were developed to safeguard against explosion hazards arising from sewage gas in its handling from digester to boiler and waste gas burners is related in a new 16-page Bulletin, No. 121^{A}, just released by the Pacific Flush-Tank Company, 4241 Ravenswood Ave., Chicago.

Typical sewage plant boiler room installations are pictured and drawings and cut-away views clearly show the design and construction and explain the operation.

Sketches of typical boiler room layouts are presented in the bulletin and also shown are P.F.T. Waste Gas Burners, Condensate Drip Traps and other boiler room accessory equipment. New tables are included to aid sewage plant engineers in determining the correct size of unit required. Copies of this bulletin are available on request.

Readers' Service Department

These booklets are FREE. Use the coupon below or write the manufacturer direct, mentioning PUBLIC WORKS.

Construction Materials and Equipment

Asphaltic Limestone

5. Characteristics, methods of laying, and results with cold lay mixture shipped ready to use. Especially adapted to resurfacing old pavements, sealcoats and airport runways. Alabama Asphaltic Limestone Co., Liberty Nat. Life Bldg., Birmingham, Ala.

Cold Mix Plants

10. New catalog and prices of Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus, Ohio.

Concrete Accelerators

33. Pocket manual of concrete curing with calcium chloride. Complete, handy. Contains useful tables, well illustrated. Write the Columbia Chemical Division, Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, N. Y. C.

Concrete Mixers

44. Catalog and prices of Concrete Mixers, both Tilting and Non-Tilt types, from 3½S to 56S sizes. The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

Concreting in Winter

47. "Build Straight Through the Cold Weather Season" explains briefly how to obtain satisfactory winter concrete in less time. Write Michigan Alkali Co., 60 East 42nd St., New York, N. Y.

Drainage Products

71. Modern Culvert Practice — a 72 page book containing valuable data and tables will be sent promptly to anyone interested in drainage by Gohi Culvert Mfrs., Inc., Newport, Ky.

72. "3 Answers to Limited Headroom," a comparison of three ways of providing safe strength and adequate drainage under limited headroom. For copy ask Armco Drainage Products Assn., Middletown, Ohio.

Generators

75. Homelite portable gasoline engine driven generators, both direct current and alternating current type, in sizes ranging from 500 watts output to 3,000 watts output, are fully described and illustrated in new folder. Homelite Corp., 2400 Riverdale Ave., Port Chester, N. Y.

Mud-Jack Method

107. How the Mud Jack Method for raising concrete curb, gutter, walls and street solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities — a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee, Wis.

Paving Materials, Bituminous

111. An excellent booklet issued by The Barrett Co., 40 Rector St., New York, N. Y., describes and illustrates the uses of each grade of Tarvia and Tarvialithic; 32 good illustrations.

Paving Materials, Brick

116. "New Developments in Brick Pavements." A review of the developments in brick pavements in recent years. Issued by the National Paving Brick Association, National Press Building, Washingon, D. C.

Pumps

121. New illustrated catalog and prices of Jaeger Sure Prime Pumps, 2" to 10" sizes, 7000 to 220,000 G.P.H. capacities, also Jetting, Caisson, Road Pumps, recently issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

122. CMC pump bulletin illustrates and describes complete line of modern centrifugals made in sizes from 1½" to 10" by Construction Machinery Co., Waterloo, Iowa.

123. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

124. 16-page illustrated bulletin, SP-37, describes and illustrates complete C. H. & E. line of self-priming centrifugal pumps from ½" to 8", including lightweight models for easy portability. C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

125. Homelite portable self-priming centrifugal pump, gasoline driven, in sizes from 1½" to 4", fully described and illustrated in new folder. Homelite Corp., 2400 Riverdale Ave., Port Chester, N. Y.

Retaining Walls

126. Charts showing the design of cellular or bin-type metal retaining walls, helpful suggestions on their use for stabilizing slopes, preventing stream encroachment, and solving problems of limited right of way, and construction details are given in a 16-page bulletin entitled, "ARMCO Bin-Type Retaining Walls." It is published by the Armco Drainage Products Association, Middletown, Ohio, and member companies. Ask for Bulletin H-37.

Road Building and Maintenance

127. See road work as it was done in the 1890's and as it can be done by a full line of this year's road building equipment. See, in this new action picture book, the first reversible roller, 1893 World's Fair Award Grader and how methods have changed. Attractive new booklet AD-1796 recently issued by The Austin-Western Road Machinery Co., Aurora, Ill.

128. Motor Patrol Graders for road maintenance, road widening and road building, a complete line offering choice of weight, power, final drive and special equipment to exactly fit the job. Action pictures and full details are in catalogs Nos. 253, 254 & 255, issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

129. New bulletins illustrate and describe the latest line of Littleford Utility Spray Tanks, Street Marking Units, Street Flushers and Kettles. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

130. Toro patching rollers, tractors and mowers for parks, airports, estates, highways and golf courses are pictured and detailed in new illustrated booklet available from Toro Mfg. Co., Minneapolis, Minn.

Rollers

133. New Tu-Ton roller of simple construction for use in rolling sidewalks along highways, playgrounds and other types of light rolling is fully described in a bulletin issued by C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

138. "The Buffalo-Springfield line of road rollers (tandem, 3-wheel, and 3-axle) are described in the latest catalog issued by the Buffalo-Springfield Roller Co., Springfield, Ohio."

139. "Ironeroller" 3 Axle Roller for extra smooth surfaces on all bituminous work. Booklet contains roller data and operation details. Hercules Co., Marion, Ohio.

Spreader

147. Jaeger Paving equipment, including Mix-in-Place Roadbuilders, Bituminous Pavers, Concrete Bituminous Finishers, Adjustable Spreaders, Forms, etc.— 4 complete catalogs of latest equipment in one cover, issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

Soil Stabilization

150. "High-Service, Low Cost Roads" is one of the newer booklets using an effective combination of picture and text to set forth the principals and advantages of road surface stabilization with calcium chloride. Complete, interesting and well illustrated. 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York, N. Y.

152. The Columbia Alkali Corporation, will be glad to furnish to anyone interested complete information dealing with Calcium Chloride Stabilized Roads. This literature contains many charts, tables and useful information and can be obtained by writing Columbia Alkali Div., Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, New York City.

153. "Rock Salt for Stabilized Roads" is a handy, illustrated booklet telling how to construct and maintain salt-soil-stabilized roads. Sent on request by International Salt Co., Scranton, Pa.

154. "Soil Stabilization with Tarvia" —An illustrated booklet describing The steps in the stabilization of roadway soil with Tarvia will be mailed on request by The Barrett Company, 40 Rector St., New York, N. Y.

Steel Forms

156. Complimentary Bulletin A-20-F, issued by The Heltzel Steel Form and Iron Co., Warren, Ohio, contains complete information on the use of steel forms for constructing concrete curbs, curb and gutters and sidewalks.

Tire Data

158. Handy pocket-size Goodyear Truck Tire Data Book contains load and inflation tables, dimenson data, factors governing mileage, for all types and sizes of truck, earthmoving and road grader tires. Also tables of weights and measures. Write Truck and Tractor Tire Div., Goodyear Tire & Rubber Co., Akron, O.

Tractors

159. "International Diesel TracTracTors" is a 48-page catalog giving full details of TracTracTors, including action pictures with bulldozers, bullgraders, blade graders, wheel scrapers, elevating graders, etc. Sent promptly by International Harvester Co., 180 North Michigan Ave., Chicago, Ill.

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5-41

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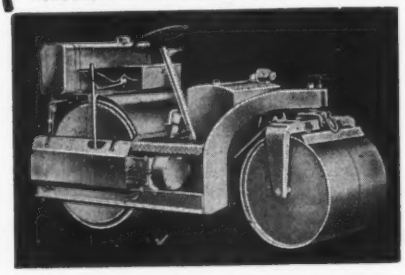

Readers' Service Department

(Continued from page 63)

Street and Paving Maintenance

Asphalt Heaters

198. Illustrated Bulletins 15 to 20 describe Mohawk Oil Burning Torches; "Hotstuf" Tar and Asphalt Heaters; Portable Trailer Tool Boxes; Pouring Pots and other equipment for street and highway maintenance, roofing, pipe coating, water proofing, etc. Mohawk Asphalt Heater Co., Frankfort, N. Y.

199. Aeroil "Heet-Masters" for quick heating and melting of tar, pitch, asphalt, etc., with less fuel are illustrated and explained in new catalog No. 196W issued by Aeroil Burner Co., Inc. Box 599, West New York, N. J.

Dust Control

210. "How to Maintain Roads with Dowflake" is a new 58 page illustrated booklet of information on stabilized road construction. Includes specifications and several pages of reference tables from an engineer's notebook. Issued by Dow Chemical Co., Midland, Mich.

211. A complete booklet on dust control titled. "Dust Control and Road Stabilization," describes the use of Columbia Calcium Chloride for dust control purposes and stabilization of roads. Sent on request by Columbia Alkali Div., Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, New York, N. Y.

212. "Are you Annoyed by Dust?" an illustrated circular telling how to prevent dust with calcium chloride. Sent free by Michigan Alkali Co., 60 East 42 St., New York, N. Y.

Radio Communication, Two Way

250. Valuable information on how cities and towns all over the country have solved their radio communication problems is found in "Motorola Radio Communication Equipment." Write Galvin Mfg. Corp., 4545 West Augusta St., Chicago, Ill.

Sprayers

280. Cutback sprayers with new "single unit safety control" and full control of all spraying operations from the nozzle are described and illustrated in new bulletin No. 190 W issued by Aeroil Burner Co., Box 599, West New York, N. J.

Street Markers

300. Street marking simplified by the use of modern, self-contained units capable of handling any kind of striping jobs is the subject of an illustrated bulletin giving also full details of new M-B Street Markers. Sent by Meili-Blumberg Corp., Box PW, New Holstein, Wis.

Snow Fighting

Plows

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

Ice Control

351. "Make Icy Highways Safe for Traffic"—a new bulletin by Michigan Alkali Co., 60 East 42 St., New York, N. Y., tells how to use calcium chloride for modern ice control.

352. "Rock Salt's 'Auger Action' makes it most effective for removing ice from roads and streets" is a new illustrated folder just issued by International Salt Co., Scranton, Pa.

Sanitary Engineering

Aero-Filter

356. New illustrated bulletin gives complete information on design of Aero-Filters to provide high-capacity, uniform, raindrop application over the entire filter bed. Write Lakeside Engineering Corp., 222 West Adams St., Chicago, Ill.

Air Release Valves

357. Automatic Air Release Valves for water, sewage and industrial uses are dscribed and illustrated in new catalog issued by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

Activation and Aeration

376. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability. 20pp. illustrated. Sent on request to Norton Company, Worcester, Mass.

Cleaning Sewers

383. A 20-page booklet describes and illustrates a full line of sewer cleaning equipment—Rods, Root Cutters, Buckets, Nozzles and Flushers. Write W. H. Stewart (Pioneer Mfr. since 1901), Jacksonville, Fla., or P. O. Box 767, Syracuse, N. Y.

Diesel Engines

386. Write Dept. 118, Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago, Ill., for data on how the installation of F-M diesels has lowered taxes and made it possible for many communities to pay for their improvements out of municipal power plant earnings.

Feeders, Chlorine, Amonia and Chemical

387. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers, Inc. % 96 Codding St., Providence, R. I.

Filter Plant Controllers

389. "The Modern Filter Plant" and the uses of Simplex Controllers for operation are described in a handy, 16-page booklet. Charts, data, curves and tables. Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Fire Hydrants

390. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Anniston, Ala.

391. See listing No. 410.

Flow Meters

393. The primary devices for flow measurement—the orifice, the pilot tube, the venturi meter and others — and the application to them of the Simplex meter are described in a useful 24-page booklet (42A). Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Gates, Valves, Hydrants

394. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

395. Complete booklet with much worthwhile water works data describes fully Ludlow hydrants and valves. Sent on request. Ludlow Valve Mfg. Co., Troy, N. Y.

396. See listing No. 410.

Gauges

398. The full line of Simplex gauges for filtration plants are illustrated and described in catalog issued by Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Hypochlorinators

400. New illustrated booklet W&T 357 describes this simple, inexpensive means of protecting small water supplies such as summer camps, hotels, swimming pools, dairies, etc., as well as for feeding chemical solutions in the water works plant. Contains typical installation sketches. Write "Wallace & Tiernan Co., Inc., Newark, N. J.

Manhole Covers and Inlets

402. Street, sewer and water castings in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., Lafayette Boul. and Indiana Ave.. South Bend, Ind.

Manhole Cover Silencers

403. New bulletin on Tapax for quickly ending noisy manhole covers and small sample free. Write Tapax Mfg. Co., 201 Hoyt Ave., Mamaroneck, N. Y.

Meters, Venturi

405. MS Meters for use with venturi tubes, flow nozzles, etc., in wall, panel, or floor mounting are covered in detail in catalog sent free by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

406. New bulletin illustrates Builders Air Relay system of transmission for the Venturi Meter which is particularly useful for liquids containing suspended solids like sewage. Eliminates corroson, clogged pipes, etc. Write Builders Iron Foundry, Codding St., Providence, R. I.

Meters, Water

407. Complimentary bulletin W529 tells all about Pittsburgh IMO water meters, "the meters that wear in where others wear out." Write Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Pipe, Cast Iron

408. Handbook of Universal Cast Iron Pipe and Fittings, pocket size, 104 pages, illustrated, including 14 pages of useful reference tables and data. Sent by The Central Foundry Co., 386 Fourth Ave., New York, N. Y.

409. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

410. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., 400 Chestnut St., Philadelphia, Pa.

Pipe Forms

411. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe, Reinforced Concrete

412. Literature describing the manufacture and installaton of Lock Joint Reinforced Concrete Pressure Pipe for water supply lines and sewer force mains. Lock Joint Pipe Co., Ampere, N. J.

Pipe, Transite

413. Two new illustrated booklets, "Tansite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., 22 East 40th St., New York, N. Y.

Pipe Joints, Sewer

415. How to make a perfect sewer pipe joint—tight, prevents roots entering sewer, keeps lengths perfectly aligned; can be laid with water in trench or pipe. General instructions issued by L. A. Weston, Adams, Mass.

Pumps and Well Water Systems

420. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Advertising Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis, Tenn.

Meter Setting and Testing

430. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

Sand Expansion Indicator

432. New bulletin gives full details of Simplex Sand Expansion Indicators for water plants. Write Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

434. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill.

Steel Sheet Piling

435. Steel sheet piling to speed sewer jobs is covered in illustrated catalog containing complete production specifications. Write Dept. PW-2, The Union Metal Mfg. Co., Canton, Ohio.

436. "ARMCO Sewers" is the title of a 48-page booklet describing the structural and other advantages of ARMCO Ingot Iron. Paved Invert and Asbestos-Bonded pipe for storm and sanitary sewers. Design data and large charts will be found helpful by engineers engaged in the design or construction of sewers. Copies will be sent on request by the Armco Drainage Products Association, Middletown, Ohio, or its associated member companies.

437. "Metal Sheeting for Lower Average Job Costs" is a new bulletin about light weight sheeting you can use again and again. Issued by Armco Drainage Products Assn., Middletown, Ohio.

Septic Tanks, Small

438. Septic Disposal Systems, Waterless Toilets, Multiple Toilets for Camps and Resorts, and other products for providing safer sewage disposal for unsewered areas are described and illustrated in data sheets issued by San-Equip Inc., 504 E. Glen St., Syracuse, N. Y.

Sludge Drying and Incineration

440. "Disposal of Municipal Refuse." Complete specifications and description including suggested form of proposal; form of guarantees; statements and approval sheet for comparing bids with diagramatic outline of various plant designs. 48 pages. Address: Morse Boulger Destructor Co., 216-P East 45th St., New York, N. Y.

441. Full information about Nichols modern, efficient gabage and refuse incinerators now available in the Basket Grate, Continuous Grate, Revolving Grate and Monohearth types will be sent promptly by Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

442. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebusters for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

443. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes — a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

Swimming Pools

446. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

447. 40-page Manual on swimming pools. Includes swimming and pool layouts, specifications, etc., and details concerning Permutit Swimming Pool Equipment. Write The Permutit Co., Dept. G-4, 330 West 42 St., New York, N. Y.

Taste and Odor Control

450. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination, a method of discovering the point at which many causes of taste may be removed by chlorination with little or no increase in residual chlorine. Sent free to any operator requesting it.

Treatment

453. "Safe Sanitation for a Nation," an interesting booklet containing thumbnail descriptions of the different pieces of P.F.T. equipment for sewage treatment. Includes photos of various installations and complete list of literature available from this company. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill.

455. New booklet (No. 1642 on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures; drawings of installations, sanitary engineering data and design details. Link-Belt Company, 2045 W. Hunting Park Ave., Philadelphia.

456. New 16-page illustrated catalog No. 1742 on Straightline Collectors for the efficient, continuous removal of sludge from rectangular tanks at sewarage and water plants. Contains layout drawings, installation pictures, and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia, Pa.

457. New illustrated folder (1942) on Straightline apparatus for the removal and washing of grit and detritus from rectangular grit chambers. Address: Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

458. "Sedimentation with Dorr Clarifiers" is a complete 36-page illustrated catalog with useful design data. Ask The Dorr Company, 570 Lexington Ave., New York, N. Y.

459. A combination mechanical clarifier and mechanical digester, The Dorr Clarigester, is explained and illustrated in a bulletin issued by The Dorr Company, 570 Lexington Ave., New York, N. Y.

460. This new 145 page illustrated chemical products book contains 55 pages of Tables, Factors and valuable Reference Data. Issued by General Chemical Co., 40 Rector St., New York, N. Y.

461. Prefloccuation without chemicals with the Dorrco Clarifloculator in a single structure is the subject of a new booklet issued by The Dorr Company, 570 Lexington Ave., New York, N. Y.

462. Dorrco Monorake for existing rectangular sedimentation tanks, open or closed, is described and illustrated in a new catalog sent on request. The Dorr Co., 570 Lexington Ave., New York, N. Y.

Tunnel Liners

480. "Save Money with Armco *Light Duty* Tunnel Liner" is a bulletin you'll want if you are interested in economical, long lasting tunnels. Write Armco Drainage Products Assn., Middletown, Ohio.

Valves (See Gates, Air Release, etc.)

Water Works Operating Practices

490. "Important Factors in Coagulation" is an excellent review with bibliography and outlines of latest work done in the field. Written by Burton W. Graham and sent free on request to Activated Alum Corp., Curtis Bay, Baltimore, Md.

491. "Soft Water for Your Community" tells by means of many interesting pictures and text the advantages of soft water to any community. Ask for a copy from The Permutit Co., Dept. G4, 330 West 42nd St., New York, N. Y.

492. "Alkalies and Chlorine in the treatment of Municipal and Industrial Water" is a new comprehensive survey filled with tables, charts, cost comparisons, etc., valuable to all who treat large volumes of water. Write Solvay Sales Corp., 40 Rector Street, New York City.

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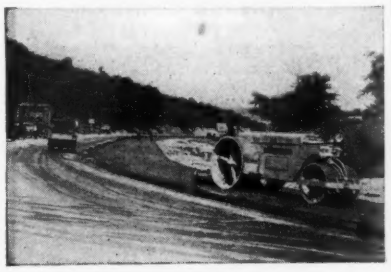

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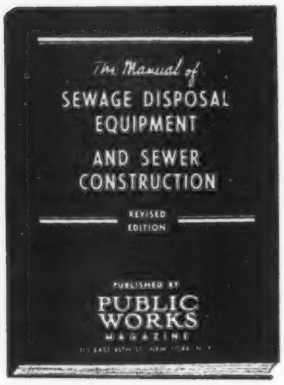

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For the Engineer's Library

Brief reviews of the latest books, booklets and catalogs for the public works engineer.

SUBDIVISION REGULATIONS. By Harold W. Lautner. 346 pages, tables, figures. $3.75.

SUBDIVISION REGULATIONS presents the first comprehensive analysis of platting regulations both past and present. In the production of the work, use was made of some 284 regulations and about 200 communications from various public officials. The study includes not only all subdivision regulations now in effect which could be secured, but also regulations which have since been suspended and suggested regulations which have never been adopted, on the theory that an idea is an idea wherever it may be found.

The objective of this volume has been more than a compilation of existing platting regulations, more even than a critical study and analysis—although these two features form the framework of the study. The primary aim has been the preparation of a kind of manual of platting and land subdivision information which would present the planning goal of each different kind of regulation, show if possible the strong and the weak points of the regulations already in effect, and, when feasible, suggest the type of regulation most likely to accomplish the desired result.

THE MUNICIPAL YEAR BOOK, 1941. International City Managers' Association, 1313 East 60 Street, Chicago. Published April, 1941. 664 pp. $5.00.

This volume, now in its eighth edition, contains more information than ever before on all of the cities over 5,000 population, including 1940 census population data. A total of 234 cities have been added to the Year Book tables as a result of the 1940 census. The new sections include data on municipal airports, sewer rental data from 170 cities, information on municipally owned electric plants in cities over 5,000, statistics on municipal health departments, retirement systems, and credit unions. The model ordinance section has been enlarged, and new information has been included in the sections on annual reports, police, fire, housing, traffic safety, and parking meters.

Contractors and Mining Tools

A new catalog describing the complete line of Thor Air-Powered Tools has just been issued by the Independent Pneumatic Tool Company, 600 W. Jackson Blvd., Chicago, Ill. Probably one of the most outstanding books of its kind, it contains complete descriptions and specifications of all Thor rock drills, paving breakers, clay and trench diggers, sump pumps, saws and associated air tools.

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